

CDAPP Sweet Success Guidelines for Care

State Program Guide

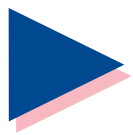
California Diabetes and Pregnancy Program:
Sweet Success

**California Department of Public Health,
Center for Family Health
Maternal, Child & Adolescent Health Division
2015**



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California Diabetes and Pregnancy Program



CDAPP Sweet Success Guidelines for Care

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California Department of Public Health

California Diabetes and Pregnancy Program Sweet Success Guidelines for Care

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LIST OF ACRONYMS

AADE	American Association of Diabetes Educators
ACOG	American Congress of Obstetricians and Gynecologists
ADA	American Diabetes Association
A1c	Hemoglobin A1c
BG	Blood Glucose
BMI	Body Mass Index
BMS	Behavioral Medicine Specialist
CDAPP	California Diabetes and Pregnancy Program
CDC	Centers for Disease Control
CDE	Certified Diabetes Educator
CGMS	Continuous Glucose Monitoring System
CHO	Carbohydrate
CSII	Continuous Subcutaneous Insulin Infusion (i.e. insulin pump)
DBW	Desirable Body Weight
DKA	Diabetic Ketoacidosis
DM1	Diabetes Mellitus, Type 1
DM2	Diabetes Mellitus, Type 2
DPN	Distal Peripheral Neuropathy
EER	Estimated Energy Requirement
EPDS	Edinburgh Postnatal Depression Scale
FBG	Fasting Blood Glucose
FPG	Fasting Plasma Glucose
GDM	Gestational Diabetes Mellitus
GCT	Glucose Challenge Test
GI	Glycemic Index
HAPO	Hyperglycemia Adverse Pregnancy Outcome
I:CR	Insulin to Carbohydrate Ratio
IFG	Impaired Fasting Glucose, AKA pre-diabetes
IGT	Impaired Glucose Tolerance, AKA pre-diabetes
IUGR	Intra-uterine Growth Restriction
LGA	Large for Gestational Age
MDI	Multiple Daily Injections (of insulin)
MNT	Medical Nutrition Therapy
MSW	Master of Social Work
NSVD	Normal Spontaneous Vaginal Delivery
OGLA	Oral Glycemic Lowering Agent
OGTT	Oral Glucose Tolerance Test
OHA	Oral Hypoglycemic Agents
PCOS	Polycystic Ovary Syndrome
PDM	Preexisting Diabetes Mellitus
PPD	Post Partum Depression
PTH	Para Thyroid Hormone
RD	Registered Dietitian
RDS	Respiratory Distress Syndrome
SGA	Small for Gestational Age
SC	Subcutaneous
SMBG	Self-Monitoring of Blood Glucose
TDD	Total Daily Dose (of insulin)
TTN	Transient Tachypnea of the Newborn

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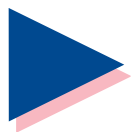
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Chapter 1

Overview



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1 Overview

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1 Overview

HISTORY OF CALIFORNIA DIABETES AND PREGNANCY PROGRAM (CDAPP) SWEET SUCCESS

CDAPP Sweet Success began as a pilot project in San Francisco in 1982, originally funded by the March of Dimes. Based on the success of that pilot project, the inland counties in southern California became the first CDAPP regional program funded by the federal Title V Block Grant through the California Department of Public Health (CDPH), Maternal, Child and Adolescent Health (MCAH) Division.

From 1984 through 2006, the number of CDAPP Sweet Success regional programs gradually expanded to ten. Regional CDAPP staff recruited, trained, supported and retained local CDAPP Sweet Success Affiliates who provided health care services to pregnant women with preexisting or gestational diabetes. Prior to CDAPP Sweet Success, pregnant women with diabetes received minimal intervention. Today, CDAPP Sweet Success Affiliates are widely available across the state, providing care for thousands of pregnant women each year.

CDAPP Sweet Success regional programs were originally established based on the regional perinatal health systems model. The regional program consisted of a multidisciplinary team that ideally included a diabetes nurse educator, a registered dietitian, and a behavior medicine specialist who worked in conjunction with a regional medical director. Due to budget shortfall, funding for ten regional CDAPP Sweet Success programs ended in June 2012. A new statewide CDAPP Sweet Success Resource and Training Center was established starting July 1, 2012 to support and train our CDAPP Sweet Success Affiliates.

MISSION OF CDAPP SWEET SUCCESS

The mission of CDAPP Sweet Success is to promote best practices of care for pregnant women who have preexisting or gestational diabetes. CDAPP Sweet Success strives to optimize maternal and neonatal birth outcomes, slow or prevent ongoing diabetes among women with gestational diabetes, and reduce complications of diabetes among women with preexisting diabetes.

PURPOSE OF CDAPP SWEET SUCCESS

The purpose of CDAPP Sweet Success is to improve maternal and neonatal birth outcomes through health education and promotion, and disease prevention. The CDAPP Sweet Success Resource and Training Center staff recruit, support, retain and provide resources for the training of Sweet Success Affiliates who provide health care services to pregnant women who have preexisting or gestational diabetes using the *CDAPP Sweet Success Guidelines for Care*. The Resource and Training Center staff assess education and training needs and coordinate efforts to assist local Sweet Success Affiliates to plan, develop and deliver care for pregnant women with diabetes.

THE GOALS OF CDAPP SWEET SUCCESS

The goals of CDAPP Sweet Success are to:

1. Promote quality medical management, psychosocial and nutrition interventions for women with diabetes or for women who develop diabetes during pregnancy so their pregnancy outcomes match those of women in the general population with respect to:
 - ❖ Intrauterine growth patterns
 - ❖ Birth defects
 - ❖ Morbidity and mortality of both mother and infant
2. Promote healthy lifestyle changes in order to prevent recurrent gestational diabetes or development of diabetes after pregnancy and to prevent the complications of diabetes among women who have overt diabetes.

The overall CDAPP Sweet Success goals are accomplished by:

- ❖ The CDAPP Sweet Success Resource and Training Center which develops and maintains web-based training and disseminates diabetes resources. The Center provides web-based information to affiliated health care professionals and clinics who provide services to pregnant women with preexisting diabetes or women who develop diabetes while pregnant.
- ❖ CDAPP Sweet Success Affiliates who promote optimal management of diabetes, before, during, and after pregnancy. Affiliates are encouraged to:
 - Use the *CDAPP Sweet Success Guidelines for Care*.
 - Utilize interdisciplinary health care teams to provide preventive and health promoting strategies that are culturally appropriate and research-based.
 - Collect and analyze clinical data for validation of services to patients and for quality improvement (QI) activities.

FUNDING

CDAPP Sweet Success Resource and Training Center is a project of CDPH/MCAH. MCAH State Program Consultants for CDAPP Sweet Success, provide direction and oversight in communicating the Title V goals and objectives to the CDAPP Sweet Success Resource and Training Center.

The CDPH/MCAH Division allocates Title V Block Grant Funds to support the work of CDAPP Sweet Success Resource and Training Center in order to accomplish the Program's mission and goals.

**CDAPP SWEET SUCCESS
- ROLE OF THE TEAM**

The CDAPP Sweet Success Affiliates care for pregnant women with diabetes using a multidisciplinary team. The team is comprised of various health care professionals, depending on the health care setting, and can include physicians, nurse educators, nurse practitioners, certified nurse midwives, health educators, physician assistants, behavioral medicine specialists (social workers, marriage/family therapists, and clinical psychologists), registered dietitians, and medical assistants. The roles of these team members may overlap in some cases, but all team members work closely with the woman throughout her pregnancy. Team members need understanding of the physiology and management of pregnancies complicated by diabetes as well as experience in educating women about diabetes-related issues.

MCAH provides:

- ❖ Title V federal funding for CDAPP Sweet Success Resource and Training Center.
- ❖ Program Consultants who deliver direction and oversight in communicating the MCAH Title V goals and objectives to the CDAPP Sweet Success Resource and Training Center.

CDAPP Sweet Success Resource and Training Center provides:

- ❖ The *CDAPP Sweet Success Guidelines for Care*.
- ❖ The CDAPP Sweet Success Resource and Training Center Website.
- ❖ The CDAPP Sweet Success materials and brochures to affiliates and providers in electronic formats.
- ❖ Monthly web-based educational trainings for existing and new CDAPP Sweet Success Affiliates.
- ❖ Assistance to affiliates in order to maintain their Memorandum of Understanding (MOU) and inclusion in the online CDAPP Sweet Success Affiliate Directory.
- ❖ Collection of CDAPP Sweet Success Affiliate On-line Annual Surveys including number of clients served.
- ❖ Annual Certificates of Affiliate Status that can be displayed verifying the site has met requirements.
- ❖ An Annual Report to the MCAH Division.

CDAPP Sweet Success Affiliates provide:

- ❖ A health care team knowledgeable about the *CDAPP Sweet Success Guidelines for Care* which utilizes these guidelines in their current practice.
- ❖ Patient management based upon participation in CDAPP Sweet Success training programs.
- ❖ Comprehensive clinical preconception and pregnancy care for women with diabetes.
- ❖ Clinical competency by ongoing participation in monthly educational programs.
- ❖ Data collection about the care they provide to clients in order to self-monitor and evaluate their clinical practices.
- ❖ Feedback and sharing of their goals and plans with the CDAPP Sweet Success Resource and Training Center staff through an annual on-line site survey.

- ❖ Promotion of diabetes awareness in the community and participation in diabetes educational programs.

CDAPP Sweet Success affiliates can be located at:

<http://www.cdappssweetsuccess.org/Affiliates/AffiliateLocator.aspx>

AADE7 SELF-CARE BEHAVIORS™ FRAMEWORK

The American Association of Diabetes Educators (AADE) created a framework known as the AADE7 Self-Care Behaviors™ Model.¹ This AADE7 Self-Care Behaviors™ Framework will be utilized throughout the *CDAPP Sweet Success Guidelines for Care*. It also is listed in the table below:

Table 1 The AADE7 SELF-CARE BEHAVIORS™¹
1. Healthy Eating – Understanding the best times of the day to have meals, controlling portion size and choosing nutritious food for daily snacks and meals
2. Being Active – Important for overall fitness and reduces risk for DM2
3. Monitoring – Including SMBG, blood pressure, urine ketones and weight
4. Taking Medication – Use of medications from oral to injections
5. Problem Solving – Ability to recognize signs and symptoms and make informed decisions
6. Reducing Risks – Keeping up with preventative care such as routine dental, foot and eye exams as well as discontinuing unhealthy habits such as smoking
7. Healthy coping – Psychological and social elements can hinder or motivate a diabetic individual. A diabetes educator should allow a patient the opportunity to express patient fears or anxieties and offer coping mechanisms for things out of their control.

FOR MORE INFORMATION

The *CDAPP Sweet Success Guidelines for Care* are intended to assist members of the health care team to provide optimal health education and care during preconception for women with preexisting diabetes and during pregnancy for women with preexisting diabetes or gestational diabetes mellitus (GDM). They were developed from a careful review of current literature and in collaboration with recognized experts in the field. The authors and editors hope the reader will find these guidelines provide accurate and useful basic-level information about the health care of pregnant women with diabetes. The toolkit is considered a resource, but does not define the standard of care in California. Readers are advised to adapt the guidelines and resources based on their local facility’s level of care and patient populations served and are also advised to not rely solely on the guidelines presented here.

REFERENCES

1. American Association of Diabetes Educators. AADE7 Self-Care Behaviors™. American Association of Diabetes Educators Web site. <https://www.diabeteseducator.org/patient-resources/aade7-self-care-behaviors>. September 10, 2015.

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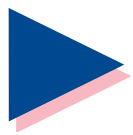
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CDAPP Sweet Success

Guidelines for Care

Chapter 2

Preconception and
Interconception Care
for Preexisting
Diabetes



*Sweet
Success*

California Diabetes and Pregnancy Program

California Diabetes and Pregnancy Program Sweet Success Guidelines for Care

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The California Diabetes and Pregnancy Program (CDAPP) Toolkit “CDAPP Sweet Success Guidelines for Care” was reviewed by the California Department of Public Health; Maternal, Child and Adolescent Health Division. The toolkit is considered a resource, but does not define the standard of care in California. Readers are advised to adapt the guidelines and resources based on their local facility’s level of care and patient populations served and are also advised to not rely solely on the guidelines presented here.

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2 Preconception and Interconception Care for Preexisting Diabetes

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2 Preconception and Interconception Care for Preexisting Diabetes

This chapter is intended to provide recommendations to providers for medical management and health education of women with preexisting diabetes, pre-diabetes, or insulin resistant syndromes. These recommendations should be utilized for these women before they become pregnant for the first time or during the interconception time between pregnancies.

This section includes several tables to guide the provider and staff to provide preconception and interconception care.

INTRODUCTION TO PRECONCEPTION CARE

The Center for Disease Control and Prevention (CDC) offer 10 healthy habits for preconception health that are recommended not just for women with preexisting diabetes but for all women.¹ They are as follows:

CDC's 10 Healthy Habits for Preconception Health and Health Care¹

1. Make a Plan and Take Action
2. See Your Doctor
3. Take 400 Micrograms of Folic Acid Every Day
4. Stop Smoking, Using "Street" Drugs, and Drinking Excessive Amounts of Alcohol
5. Avoid Toxic Substances
6. Reach and Maintain a Healthy Weight
7. Get Help for Violence
8. Learn Your Family History
9. Get Mentally Healthy
10. When You're Ready--Planning Your Pregnancy

For more information on each of these 10 items, visit the CDC webpage on preconception health:

- ✓ <http://www.cdc.gov/preconception/women.html>

Preconception management encourages conception by choice rather than chance. It promotes long-term healthy behaviors, and identifies the need for risk management during pregnancy. It recommends lifestyle practices to improve the probability of healthy pregnancy outcomes including long-term benefits to families.

Health science has established that maintaining optimal health across one's lifespan is vital. For women with preexisting diabetes or other insulin resistant conditions such as polycystic ovary syndrome (PCOS), the preconception period is the optimal time for assessment, medication

modification and behavioral changes. The best time for creating the most favorable pregnancy outcomes is before the woman becomes pregnant.

Family Planning

Couples planning to become pregnant should continue their family planning method until the woman has achieved glycemic control and stabilized any concurrent conditions. Once this has occurred, conception is considered safe. Refer to *Appendix A* for information on contraception options for women with diabetes mellitus.

Folic Acid Supplementation

Evidence links folic acid intake, called folate in its natural form, with protection against neural tube defects in the fetus. It is recommended that all women of reproductive age, regardless of diabetes status, consume synthetic folic acid daily from either a fortified cereal or vitamin pill containing 400 mcg of folic acid. Once pregnant, the daily requirement increases to 600 mcg, but this also can be met by consuming the 400 mcg of synthetic folic acid daily and eating a healthy diet that includes folate rich food. The upper intake limit is 1000 mcg per day.²

**GOALS OF
PRECONCEPTION
CARE**

The goal for preconception care is to stabilize glycemia, and control complications or concurrent disorders. Preconception care assists women to promote lifestyle changes and diabetes management that is necessary to optimize pregnancy outcomes. Self-management may need to be rigorous to maintain tight control.

The goals of preconception care are described below in Table 1.³

Table 1. GOALS OF PRECONCEPTION CARE
<p>To counter the increased proportion of spontaneous abortions and congenital malformations found in infants of diabetic mothers. This is achieved by:</p> <ul style="list-style-type: none"> ❖ Utilizing an effective contraceptive method until appropriate glycemia is reached and stabilized. ❖ Assisting women to achieve an A1c <6.0% prior to conception. ❖ Identify additional diabetes-associated co-morbidities. Counsel the patient on associated pregnancy risks and treat as indicated. ❖ Establish a care plan that involves patient participation and a multidisciplinary team approach when possible.

**PRECONCEPTION
CARE FOR
PREEXISTING
DIABETES**

Poorly controlled diabetes before conception and during the first trimester can cause spontaneous abortions in 15% to 20% of pregnancies and major birth defects in anywhere from 4.8-16.8% of pregnancies with a proportionate increase in the rate of anomalies with increased glycosylated hemoglobin.⁴⁻⁸ Since organ development is largely accomplished by the 8th week of pregnancy, it is critical to achieve desired glycemic goals prior to conception. Women with preexisting diabetes are at risk for diabetic complications⁹⁻¹¹, and face a greater risk of preeclampsia, pyelonephritis, polyhydramnios, preterm birth, cesarean delivery and birth trauma.^{4,12} While preconception care is strongly recommended, only 25-30% of childbearing age women with diabetes seek this care.¹² CDAPP Sweet Success providers strive to improve these statistics.

Kitzmilller et al demonstrated that when women enrolled in a preconception program prior to pregnancy and achieved good control, they had significantly reduced major fetal anomalies. Specifically, 1.2% of women who enrolled prior to pregnancy had fetal anomalies versus 11% for women who enrolled in the program after the first trimester.⁶ Preconception care with strict glycemic control significantly reduces hyperglycemia related mortality and morbidity.⁷ The risk of malformations will increase if the level of glycemia is increased during the first 6 - 8 weeks of gestation (first trimester).

Preconception care is highly effective with a coordinated multidisciplinary team. Each time a woman of childbearing age (12 - 50 years) with diabetes sees a health care provider, it should be regarded as a preconception visit.⁸ It should be noted that this same concept can be applied to all women of reproductive age.

The medical history that should be obtained in a preconception visit is outlined in Table 2.

1. Classify the patient’s hyperglycemic disorder: prediabetes, type 1 diabetes, type 2 diabetes, or Polycystic Ovary Syndrome.
2. Identify diabetic complications such as chronic hypertension, nephropathy, retinopathy, and coronary heart disease.
3. Obtain any history of infertility or prior obstetrical complications such as preeclampsia, preterm birth or birth of baby over 9 pounds.
4. Identify the number of prior pregnancies and birth outcomes including previous losses and complications such as cesarean birth and birth trauma.
5. Note risk factors such as obesity, advanced maternal age, and family history of diabetes.
6. Assess presence of autoimmune diseases such as hypothyroidism, hyperthyroidism, lupus, arthritis, or celiac disease.
7. Gather information about patient’s level of knowledge concerning diabetic care such as meals, activity, medication and problem solving.

Recommendations for physical examination and laboratory tests for a woman with preexisting diabetes during the preconception period or at the first prenatal visit are included in Table 3.

Table 3. ASSESSMENT, PHYSICAL EXAMINATION AND LABS FOR WOMEN WITH PREEXISTING DIABETES^{3,4,7,12,13}			
Categories/ Complications/ Recommended Test/ Frequency	Target	History/ Signs and Symptoms	Rationale /Risk
Glycemic / Metabolic Control			
<p>Glycemic Control A1c: Repeat every 3 months throughout pregnancy.</p> <p>SBGM: Minimum fasting, premeal, post meal, bedtime, overnight, and additional testing for suspected hypo/hyperglycemia¹⁴</p>	< 6%	History of diabetic ketoacidosis, or hypoglycemia and patient awareness of signs, symptoms for these	<ul style="list-style-type: none"> • A1c < 6.0% lowers risk of birth defects and SAB to non-diabetic population incidence. • History of severe hypoglycemia or unawareness may necessitate elevated targets. • Pregnancy lowers the ability of some women to sense hypoglycemia. • Glucose control with less than 20% of values out of range appears to be adequate.
<p>Lipids^{3,13:} Fasting Lipid/ Triglyceride levels</p> <p>If fatty liver disease is suspected check AST/ALT, and obtain liver ultrasound.</p>	TG ≤ 150 mg/dL HDL ≥ 50 mg/dL LDL ≤ 100 mg/dL	Assess for history of abnormal lipids Fatty liver is associated with high BMI, and difficult glucose control. Associated with type 2 diabetes	<ul style="list-style-type: none"> • Increase with insulin resistance and deficiency. • Associated with cardiovascular events and fatty liver. • Dietary intervention and lifestyle, is the primary approach. • Statin therapy is contraindicated in pregnancy. • Fish oil and niacin have been used in pregnancy. Bile-acid binding resins are approved. Other agents should be used on individualized basis. • Fatty liver is treated with dietary, lifestyle and glycemic control and is associated with late term fetal loss.
Endocrine			
<p>Thyroid^{3,13:}</p> <ul style="list-style-type: none"> • TSH / T4 If normal no follow-up required. • T4 values should only be used to monitor patients with hyperthyroidism¹⁵ • Abnormal TSH: follow-up every 4-6 weeks during preconception, each trimester and postpartum. • Thyroid Peroxidase Antibodies TPOAbs. If negative no F/U needed. 	TSH < 2.5 mIU/mL in 1st trimester ¹⁶ If Being Treated: T4 = High Normal Range ¹⁵ Negative	If a woman has a history of hyper- or hypothyroid evaluate labs before and during pregnancy to adjust treatment	<ul style="list-style-type: none"> • Abnormal thyroid function effects fertility and increases risk of loss.¹⁶ Treatment and follow-up is recommended. • Hypothyroid increases hypoglycemia incidence and can effect fetal brain development. • Autoimmune thyroid disease is common with type 1 diabetes (35-40%).¹³ • Alert the pediatrician for positive TPOAbs and treatment.

Table 3. ASSESSMENT, PHYSICAL EXAMINATION AND LABS FOR WOMEN WITH PREEXISTING DIABETES,^{3,4,7,12,13} Continued			
Categories/ Complications/ Recommended Test/ Frequency	Target	History/ Signs and symptoms	Rationale /Risk
Macrovascular			
Hypertension^{3,12,13}: Test blood pressure (BP) at every office visit.	Systolic BP < 120 Diastolic BP < 80		<ul style="list-style-type: none"> Medication for hypertension should be evaluated for use in pregnancy. ACE and ARBs are contraindicated in pregnancy, and associated with increased incidence of gestational hypertension, preeclampsia, and IUGR. Uncontrolled hypertension is associated with progression of retinopathy.⁴
Cardiovascular			
EKG recommended for: Age ≥ 35 years old, type 1 diabetes 15 years or more; all type 2 diabetes; and all women with symptoms or significant history.	No abnormalities	Symptom history for Coronary Heart Disease: exercise intolerance; pain or heaviness in chest, neck, jaw, left arm; shortness of breath; vascular disease in extremities.	<ul style="list-style-type: none"> Appropriate treatment will reduce the significant mortality and morbidity associated with CVD. Counseling per potential needs and risks. Generally women with suspected cardiovascular disease should be referred to a cardiologist who should be included in the team.
Skin and Foot Care¹⁷			
Assess patient knowledge and instruct as necessary.	No skin breaks. Performs regular foot exams and care if necessary.	Assess history of skin breaks, foot care and infections.	<ul style="list-style-type: none"> Any skin breaks leave a woman open to infection and adversely affect glucose control. Foot deformities will affect exercise prescription.
Microvascular			
Nephropathy^{4,9,13}: Urine dip for microalbuminuria, serum creatinine <ul style="list-style-type: none"> If abnormal send for 24 hour Total protein, creatinine clearance with a serum creatinine. If abnormal follow preconception, every trimester and more often if indicated. 	Microalbumin Dip ≤ 30 mg/24hr is normal Total Protein < 150 mg/24 hr Creatinine clearance 0.7-0.9 mg/dL and GFR (Glomerular Filtration Rate) > 60 m/min/m ³	Associated with hypertension and hypertensive diseases of pregnancy, and retinopathy.	<ul style="list-style-type: none"> Mild to moderate renal insufficiency does not appear to worsen long-term outcomes. Moderate to severe renal dysfunction has been associated with long-term renal disease progression. GFR 60-98 and proteinuria > 500 mg/day are associated with increased incidence of IUGR, fetal demise, and preterm delivery. Referral to a nephrologist is recommended. Dietary intervention may be indicated.
Retinopathy^{3,4,10,11,13,17}: Dilated retinal exam Preconception and first and 3rd trimester if normal. If abnormal increase frequency as indicated.	If no retinopathy, none will develop during pregnancy. Existing retinopathy should be stabilized.	Retinopathy is associated with Nephropathy.	<ul style="list-style-type: none"> Achieving tight glycemic control slowly may prevent rapid retinal progression. This is not an option if presenting in pregnancy. Blood pressure control reduces progression. Proactive treatment such as laser or vitrectomy is encouraged, as the risk for vision loss during a pregnancy can be significant.

Table 3. ASSESSMENT, PHYSICAL EXAMINATION AND LABS FOR WOMEN WITH PREEXISTING DIABETES,^{3,4,7,12,13} Continued			
Categories/ Complications/ Recommended Test/ Frequency	Target	History/ Signs and symptoms	Rationale/ Risk
Neuropathy³ Assessment and treatment is based on symptoms by system			
Hypoglycemia unawareness	Increased frequency of SBGM as indicated.	Onset of severe hypoglycemia without warning and poor counter-regulatory response.	<ul style="list-style-type: none"> Hypoglycemia without warning symptoms may require adjusted glucose targets to protect the woman and potential offspring.
Gastrointestinal (Gastroparesis) ⁴ If symptomatic assess with gastric emptying studies	Normal gastric motility.	Feelings of fullness; nausea and vomiting; constipation alternating with diarrhea; erratic blood glucoses.	<ul style="list-style-type: none"> Increases morbidity and adverse perinatal outcomes. Treat with standard medications for hyperemesis.
Cardiovascular Pulse upon presentation to care Orthostatic hypotension Orthostatic blood pressure upon presentation to care	Resting heart rate < 100 bpm. Normal heart rate variability and EKG. BP supine and standing ≤ 20 mmHg variation, with heart rate response with position change	Early fatigue and weakness; dizziness, syncope.	<ul style="list-style-type: none"> With cardiovascular autonomic neuropathy, a woman will require a modified exercise prescription. Increases adverse perinatal outcomes and requires careful management.
Acute Sensory Neuropathy Chronic Sensorimotor Distal Peripheral Neuropathy (DPN) Mononeuropathies Entrapment	<ul style="list-style-type: none"> Without leg pain. Normal, vibration, pressure, pain, temperature perception and ankle reflexes Nerve conduction amplitude is normal Electrophysiological studies show no block in conduction 	<ul style="list-style-type: none"> Pain in legs Burning pain, stabbing; hyperesthesia, deep aching, usually worse at night. Weakness and palsies Carpal tunnel syndrome 	<ul style="list-style-type: none"> Changes in glycemic control can exacerbate pain. Neuropathy is associated with an increased injury risk. Increased perinatal complications and requires cautious management.
Other			
Oral Health^{18,19}: Any woman that has not had regular dental care or shows signs of oral disease or trauma should be referred for a dental examination.	No periodontal disease or dental caries.	Identification and treatment of periodontal disease	<ul style="list-style-type: none"> Periodontal disease is a chronic oral infection and is associated with difficult glycemic control and pregnancy complication.¹⁷ Most effective when identified and treated before pregnancy.
Celiac Disease^{3,13}: Anti-tTG or anti-EMA plus IgA If positive reconfirm. There is no need to retest.	No antibodies is normal	Type 1 diabetes	<ul style="list-style-type: none"> Untreated disease will have erratic blood glucose control. Treat with dietary intervention.

**SELF
MANAGEMENT
BEHAVIORS**

The American Association of Diabetes Educators (AADE) 7 Self-Care Behaviors™ were briefly outlined in *Chapter 1: Overview*.²⁰ These behaviors are explained in more detail in relation to preconception and interconception. They apply at all ages and stages of diabetes care and management.^{20,21}

Healthy Eating

The preconception period is an ideal time to modify a woman’s meal plan with less fear of causing hyperglycemia or causing maternal/fetal complications. *Chapter 7: Medical Nutrition Therapy* addresses these guidelines.

Being Active

The preconception period serves as a time to identify physical activities that work into a woman’s lifestyle. Women with long standing diabetes may have complications that limit activities.

Mild to moderate physical activity such as walking should be incorporated into the daily routine of a woman and optimally take place for at least 30 minutes every day. A 10-minute walk following each meal, will help to control post-meal glucose rise and reduce the need for insulin.

Exercise precautions for women taking insulin or glyburide should be provided, and are included in Table 4.

Table 4. EXERCISE PRECAUTIONS FOR WOMEN TAKING GLUCOSE LOWERING AGENTS³
Check blood glucose before and after exercise; be sure the blood glucose is at least 100mg/dL before exercising. For some women with Type 1 diabetes it may be necessary to check midway through the planned regimen and/or to snack at midpoint.
Avoid using a leg or arm for insulin injection if either extremity will be exercised heavily within 60-90 minutes of the injection. During pregnancy, the optimal site for insulin injection is the abdomen.
Keep glucose meter and a fast-acting carbohydrate source close at hand.
Drink water before, during and after exercise as needed to replenish fluid losses during physical activity.

Exercise precautions for women using a Continuous Subcutaneous Insulin Infusion (CSII) Pump²²

- ❖ If exercising within 60-90 minutes of a meal, decrease the pre-meal bolus or reduce the basal rate during the exercise period. The recommended starting point with light exercise is a reduction of 20% of basal insulin infusion and with intense exercise, a 50% reduction in basal insulin rates.
- ❖ Due to the accelerated ketone production of pregnancy, suspending the pump for more than 1 hour is not recommended. One should always have a minimal basal rate from the insulin pump when exercising.
- ❖ Start the temporary basal rate of insulin at least 30-60 minutes before the exercise and continue the temporary basal rate of insulin for the duration of the exercise.

For a more detailed discussion of physical activity refer to *Chapter 6: Exercise*.

Monitoring of Blood Glucose

- ❖ **Self-Monitoring Blood Glucose**
Women with preexisting diabetes should be advised that intensive self-monitoring of blood glucose (SMBG) can optimize maternal and fetal outcomes by helping to keep blood glucose within target ranges. SMBG provides feedback on how food, insulin and exercise interact to control blood glucose levels. Insulin and medications are adjusted based on SMBG patterns. A pattern of blood glucose control may be more easily achieved before or between pregnancies.
- ❖ **Frequency of Testing**
Women with preexisting diabetes check blood glucose a minimum of 6 times per day. These tests are: fasting, pre-meal and post-meal. Pre-meal checks are necessary when pre-meal insulin correction algorithms are used. Most women with type 1 diabetes will require more intensive SMBG that often includes but is not limited to fasting, pre-meal, post-meal, bedtime, 3AM, and more frequently if indicated.

Table 5 describes recommended frequency of glucose testing.

Table 5. FREQUENCY OF SELF MONITORING BLOOD GLUCOSE (SMBG)^{3,13,23,24}	
Type of Diabetes	When to Test
Type 1 diabetes or type 2 diabetes on Multiple Daily Insulin Injection (MDI)	Fasting, premeal, one hour after start of meals, bedtime, occasional 3 AM (or overnight)
Type 2 diabetes on oral medications	Fasting, one hour after start of meals, bedtime
Continuous Subcutaneous Insulin infusion (CSII) also referred to as “The pump”	Fasting, premeal, one hour after start of meals, bedtime, occasional 3 AM; may check pre and post snack as needed

- ❖ **Blood Glucose Targets**
A woman actively planning a pregnancy within the next 3 months should follow the same blood glucose targets as during pregnancy. Near normal glucose levels result in positive pregnancy outcomes.⁸

While CDAPP Sweet Success recommends glycemic targets for diabetes and pregnancy, targets must always be individualized. Blood glucose targets are listed in Table 6.

Table 6. TARGET BLOOD GLUCOSE FOR PRECONCEPTION/ PREGNANCY^{13,23,25,26}	
Timing of Test	Desired Blood Glucose Range
Fasting/Premeal	60 - 89 mg/dL
Premeal/Bedtime/Overnight	60 - 99 mg/dL
Peak postprandial (1 hr from start of meal)	100 - 129 mg/dL
Bedtime (HS) and over night	60 - 99 mg/dL
Mean daily glucose	>87 mg/dl, <100 mg/dL

- ❖ **Hemoglobin A1c (A1c)**
Hemoglobin A1c (A1c) is a common blood test used to both diagnose diabetes and to gauge how well the person is managing their diabetes. The A1c test reflects what percentage of hemoglobin has been coated with sugar and reflects the average blood glucose for the past two to three months.

Since the fetal development of organs, is largely accomplished by the 8th week of pregnancy, it is critical to achieve desired glycemic goals prior to conception.^{3,27,28} The A1c test is an important measure during preconception since control of blood glucose

reflected by an A1c test of < 6% prior to pregnancy, is associated with a reduced rate of congenital malformation.^{3,28} Hemoglobin A1c is monitored every 3 months in the preconception period and the goal is to attain and maintain an A1c level of < 6% before onset of pregnancy.

A1c results are affected by factors other than blood glucose. For example, factors might be hemoglobin abnormalities, blood loss, and race.²⁹

- ❖ **Continuous Glucose Monitoring System**
A Continuous Glucose Monitoring System (CGMS) should be considered when blood glucose variation and tracking have proven difficult and can be beneficial in identifying patterns which deviate from what is normally expected.^{30,31}

Studies using CGMS suggest that endogenous insulin secretion in non-diabetic pregnant women generally peaks at 70 minutes from the beginning of the meal but may vary and peak up to 90 minutes from the start of the meal.³²

- ❖ **Use of an Insulin Pump**
When using an insulin pump, pre and post snack checks are sometimes necessary. Additional blood glucose checks may be needed for activities such as driving, exercise, or during suspected hyperglycemia or hypoglycemia.²²
- ❖ **Gastroparesis**
Women with gastroparesis or delayed gastric emptying prior to pregnancy, will need to identify their individual postmeal glucose peak. Modified meal planning and medications may be indicated³ (refer to *Chapter: 7 Medical Nutrition Therapy* for more information).

Taking Medications

Two common conditions that require medications for women with diabetes before pregnancy and in early pregnancy are hypertension and hyperlipidemia.

- ❖ **Hypertension**
The target blood pressure goals are systolic blood pressure of < 120 and a diastolic blood pressure of < 80. These targets should be maintained prior to and throughout pregnancy.³ When medically appropriate, encourage non-pharmacologic therapies such as relaxation exercises, yoga and nonaerobic exercise as an adjunct to treatment. Women with hypertension should be instructed to check home blood pressure twice daily, morning and evening on the left arm while sitting up.

- ❖ **Recommendations for Managing Hypertension**
 Angiotensin converting enzyme (ACE) inhibitors or angiotensin II receptor blockers (ARBs) may cause fetal renal dysplasia. Therefore women attempting pregnancy or no longer using contraceptives and sexually active, who are taking this class of anti-hypertensive medications should be switched as soon as possible to methyldopa, a calcium channel blocker, or a beta blocker.³³ Among calcium channel blockers, diltiazem has an advantage over nifedipine since it can reduce renal albumin excretion and obliterate renal auto-regulation in diabetic women.³⁴ There are no clear recommendations for or against the use of oral antihypertensive agents in pregnant women with mild to moderate chronic hypertension.^{35,36} If the decision is made to prescribe a medication for the treatment of chronic hypertension in pregnancy, the following in Table 7 should be considered. The goal of medical therapy is to achieve blood pressures near normal (target BP < 130/80).³

Table 7. PRECONCEPTION ANTIHYPERTENSIVE MEDICATIONS^{3,33,34,37,38} (Target BP<130/80)	
Calcium channel blockers: • Nifedipine Diltiazem (associated with decreased microalbuminuria)	ACE inhibitors and ARBs in the 2nd trimester are associated with increased risk of fetal renal dysplasia
Beta blockers: • Labetalol is very commonly used	Atenolol, may inhibit fetal growth; may blunt hypoglycemic response
Methyldopa • Maybe effective but not well tolerated	Hydrochlorothiazide, a diuretic is not commonly used during pregnancy; may reduce plasma blood volume and potentially uteroplacental blood flow

- ❖ **Hyperlipidemia**
 All lipid lowering drugs are contraindicated in pregnancy but should be continued until actively attempting pregnancy.³
- ❖ **Recommendations for Managing Hyperlipidemia**
 Women with triglycerides >1000 mg/dL need treatment to reduce the risk of pancreatitis. During pregnancy, fish oil capsules may be used to attain omega-3 fatty acid intakes of 3-9 grams per day along with a low fat diet.

Lipid lowering interventions are addressed in Table 8 below:

Primary Intervention	Secondary Intervention	Not Recommended
<ul style="list-style-type: none"> • Encourage omega-3 fatty acid intakes of 3-9 gms per day. • Limit saturated fat to <7% of calories. • Limit cholesterol to <200mg/ day. • Replace transfats with monounsaturated fatty acid (MUFA) and polyunsaturated fatty acids (PUFA). • Intensify glycemic control • Walk for 20 minutes after meals. 	<ul style="list-style-type: none"> • Slow-release Niacin use is limited by tendency to raise blood glucose. Insulin dose must be adjusted to compensate. • Bile acid-binding resins are category B and have marginal efficacy when used by itself. Should be used with dietary interventions or Niacin. 	<ul style="list-style-type: none"> • Continue all lipid lowering medications until actively attempting pregnancy. Once pregnancy is attempted statins are contraindicated.

Chapter 3: Medical Management and Education for Preexisting Diabetes During Pregnancy addresses the management of hypertension and hyperlipidemia more fully.

❖ Preconception Medication Management of Diabetes

Oral Glucose-Lowering Agents

At one time, oral glucose-lowering agents (OGLA) were thought to be associated with an increased incidence of congenital malformations. However, current research suggests that malformations are more related to inadequate glycemic control before pregnancy which continues into the first trimester.

The most common OGLAs, metformin (Glucophage) and glyburide do not appear to be teratogenic.³⁸⁻⁴⁰ Once pregnant, these agents should not be discontinued but if they cannot provide adequate glycemic control, insulin should be started as soon as possible. In this situation, coordination of care between providers is important to ensure consistent care and educational messages. Providers include: endocrinologist, perinatologist, reproductive endocrinologist, nurses, social workers or behavioral medicine specialist, and registered dietitians.

Insulin

Since the advent of rapid acting insulins (lispro, aspart, apidra), many providers and patients prefer the insulin analogs to regular insulin. These insulin analogs are now used to control the one hour postmeal blood glucose levels. Regular insulin is less effective in lowering the 1 hour peak glucose, and less convenient to administer.^{3,14,41} Prescribed regimens are used to mimic endogenous insulin response.

The rapid-acting insulin analogs are effective in controlling postprandial hyperglycemia without an increased risk of hypoglycemia.^{14,41} At this time the rapid acting insulin analogs lispro and aspart, and NPH are the preferred insulins for pregnancy.

Basal insulins are used to control between-meal and overnight blood glucose levels. Women on basal insulins should consider switching to intermediate-acting NPH or to a continuous subcutaneous insulin pump before becoming pregnant.²²

A period of poor glycemic control may follow the switch in insulin type or mode. The dose of previously prescribed glargine or detemir may need to be divided into smaller doses of NPH to mimic the continuous steady action of those medications. Bolus or mealtime insulin is taken based on the blood glucose before the meal. The patient should be instructed in accurate carbohydrate counting, and should understand her individual insulin to carbohydrate ratio. She should have a pre-meal correction algorithm.^{14,22}

Premixed insulin preparations such as 70/30 cannot be fine-tuned and result in suboptimal glycemic control so they are not recommended. These medications should be discontinued before pregnancy and a basal/bolus regimen of multiple daily injections (or CSII) should be instituted.

Refer to *Chapter 3: Medical Management and Education for Preexisting Diabetes During Pregnancy* for a comprehensive review of insulin.

Continuous Subcutaneous Insulin Infusion

When multi-injection regimens fail to achieve glycemic control, the continuous subcutaneous insulin infusion pump (CSII) should be considered. The optimal time to switch from multiple daily injections (MDI) to CSII is during the preconception period.²²

The CSII pump allows the woman increased flexibility as compared with multiple daily injections (MDI), and is programmed to deliver basal rates of rapid-acting analogs to control the blood

glucose during specific time intervals for 24 hours. Multiple basal rates can be programmed to cover changing insulin needs throughout the day. For a more complete description of the continuous subcutaneous insulin infusion pump, refer to *Chapter 3: Medical Management and Education for Preexisting Diabetes During Pregnancy*.

Table 9 summarizes preconception recommendations for women with type 2 diabetes.

Table 9. PRECONCEPTION RECOMMENDATIONS FOR MEDICATIONS WITH TYPE 2 DIABETES^{3,38-40}	
Recommendations	Rationale
<ul style="list-style-type: none"> Switch from oral glucose lowering agents (OGLA) to insulin when needed to maintain glycemic targets for at least 3 months before attempting conception. 	<ul style="list-style-type: none"> OGLA often do not provide adequate glycemic control during organogenesis.
<ul style="list-style-type: none"> OGLA should not be discontinued until insulin can be started. 	<ul style="list-style-type: none"> Hyperglycemia is a recognized teratogen.
<ul style="list-style-type: none"> Continuation of metformin with addition of insulin in women with type 2 diabetes, polycystic ovary syndrome, and prediabetes may be useful to reduce insulin doses needed. 	<ul style="list-style-type: none"> Hyperglycemia is a recognized teratogen. Neither glyburide nor metformin has caused developmental toxicity in humans in limited studies.³⁹
<ul style="list-style-type: none"> If multiple daily injections (MDI) is inadequate, CSII should be considered in women with type 2 diabetes. 	

Problem Solving

Problem-solving addresses how the individual deals with barriers to achieving their goals. Problem solving requires understanding and applying the following skills:

- ❖ How to check and record blood sugars
- ❖ When to check urine ketones
- ❖ How and when to contact providers
- ❖ What to do for sick day management
- ❖ How to manage hyperglycemia and hypoglycemia

For women with preexisting diabetes, who are planning pregnancy, management of low blood glucose below 60, or high blood glucose above targeted ranges are important issues and are covered in *Chapter 7: Medical Nutrition Therapy*.

❖ Hypoglycemia

Table 10 describes clinical maneuvers to prevent and treat hypoglycemia.

Table 10. PRINCIPALS FOR THE PREVENTION AND TREATMENT OF HYPOGLYCEMIA⁴²⁻⁴⁴
<ul style="list-style-type: none"> • Balance activity and food with insulin.
<ul style="list-style-type: none"> • With the initiation of OGLA or insulin, educate regarding signs and symptoms of hypoglycemia.
<ul style="list-style-type: none"> • With the use of OGLA or insulin instruct to always carry quick acting carbohydrate snacks and glucose tabs.
<ul style="list-style-type: none"> • Glucagon education must be provided to the significant others of all women who have type 1 diabetes. Ensure patient has one or two current glucagon kits.
<ul style="list-style-type: none"> • Glucose targets may be raised for women with hypoglycemia unawareness.
<ul style="list-style-type: none"> • If hypoglycemia occurs follow these directions⁴²: <ul style="list-style-type: none"> ○ Treat with 25 grams of carbohydrate ○ Re-check blood glucose in 15 minutes ○ If blood glucose levels are still below 70 mg/dL, eat a secondary carbohydrate-rich snack
<p>If blood glucose > 50 < 70 + symptoms:</p> <ul style="list-style-type: none"> • Give 8 oz of non-fat milk. Recheck blood glucose in 15 minutes • Repeat milk if still < 70 + symptoms • Repeat blood glucose every 15 minutes until blood glucose is > 70 x 2 • Use 1/2 sandwich if there is a milk allergy
<p>If blood glucose < 50 + Symptoms:</p> <ul style="list-style-type: none"> • Give 4 oz juice [4 (4mg) glucose tabs with water]. • Recheck blood glucose in 15 minutes. If > 50 + symptoms, give 8 oz of non-fat milk, otherwise repeat juice or tabs. • Repeat blood glucose check every 15 minutes until blood glucose > 70 x 2. Have snack or next meal.
<p>If found unconscious:</p> <ul style="list-style-type: none"> • Call 911. • Give GLUCAGON 1 mg SC immediately. • May be given IM but will take longer to act.

❖ Hyperglycemia

Most women with preexisting diabetes will experience a cyclic variation in blood glucose related to their menstrual cycle. Diabetic women should be instructed on how to adjust medications or activity to achieve glycemic control during their menstrual cycle.

Hyperglycemia during the preconception or interconception periods should be addressed and stabilized to prevent progression of diabetes-related complications.

Reducing Risks

Any woman undergoing infertility treatment should have her glucose and concurrent health issues stabilized before becoming pregnant. Research has demonstrated that 3-6 months of controlled blood glucose before pregnancy will reduce the spontaneous abortion rate, and reduce the risk of retinal progression in women with retinopathy.^{3,12}

Healthy Coping

Health status and quality of life are affected by psychological and social factors. Psychological distress directly affects health and indirectly influences a person’s motivation to keep their diabetes in control (refer to *Chapter 9: Behavioral and Psychosocial Components of Care* for more information).

SUMMARY

Table 11 addresses the optimal conditions for conception.

Table 11. OPTIMAL CONDITIONS FOR CONCEPTION^{3,4,12,20}
1. A1c equal to or below 6%
2. Stable Normoglycemia (80% blood glucose in Target)
3. Demonstrate the AADE 7 Self-Care Behaviors™ ²⁰
4. Complications stabilized
5. Effective safe medications for pregnancy
6. Taking prenatal vitamins with folic acid

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Appendix A

Contraception Options for Women with Diabetes Mellitus

Method	Considerations for women with preexisting diabetes and gestational diabetes mellitus
Barrier Methods - condoms, diaphragm, cervical cap	<ul style="list-style-type: none"> ❖ Higher failure rates. ❖ Condoms provide protection against HIV and STD's. Failure rates improve with the addition of spermicides.
Hormonal Methods - birth control pills, injections, patches, vaginal rings, and implants	<ul style="list-style-type: none"> ❖ Prevent ovulation, require monitoring of weight, blood pressure, pre and post glucose, fasting lipids, and vascular screen. ❖ Not recommended for women who smoke or have micro and/or macrovascular complications. ❖ Increase the incidence of depression. ❖ May affect lipids by decreasing HDL and increasing LDL and cholesterol. ❖ Combination pills not recommended postpartum until breastfeeding is well established at 6 weeks to 3 months. Not shown to affect glucose intolerance. ❖ Progestin only will increase glucose intolerance for preexisting DM and may require medication adjustment. ❖ Progestin only for GDM will nearly triple the diabetes diagnosis above women using non-hormonal methods while breastfeeding. It is not recommended.
Spermicides	<ul style="list-style-type: none"> ❖ High failure rates if used alone. ❖ Due to high failure rate of this method, women should be offered on going preconception care.
IUD	<ul style="list-style-type: none"> ❖ Very high effectiveness at preventing pregnancy. ❖ Those that contain hormones do not have a systemic effect on blood glucose.
Natural Family Planning - periodic abstinence, calendar method, ovulation method, symptothermal method, continuous breastfeeding and withdrawal.	<ul style="list-style-type: none"> ❖ Significant failure rates. ❖ Due to high failure rate of this method, women should be offered on going preconception care.
Sterilization	<ul style="list-style-type: none"> ❖ Surgical procedure, usually not reversible.
Emergency Contraception	<ul style="list-style-type: none"> ❖ Low failure rate and is only method post sexual activity. ❖ Progestin in these products may temporarily disrupt glucose control.

For more information:

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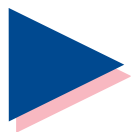
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CDAPP Sweet Success

Guidelines

for Care

Chapter 3

Medical Management and Education for Preexisting Diabetes During Pregnancy



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California Diabetes and Pregnancy Program

2015

California Diabetes and Pregnancy Program Sweet Success Guidelines for Care

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3 Medical Management and Education for Preexisting Diabetes During Pregnancy

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3 Medical Management and Education for Preexisting Diabetes During Pregnancy

INTRODUCTION

The management of Preexisting Diabetes Mellitus (PDM) has serious implications and impact on pregnancy.^{1,2} The progressive increase in insulin resistance caused by placental hormones, growth factors, and cytokines, necessitates intensive medical nutrition therapy and frequent adjustments of insulin to limit hyperglycemia and the worsening of diabetic complications. Tight glycemic control is challenging because insulin-induced hypoglycemia is more common. Women with preexisting diabetes have a fourfold to fivefold increase in perinatal mortality and a four to sixfold increase in stillbirth compared with the non-diabetic population.³

Glycemic control, as measured by Hemoglobin A1c (A1c), should be addressed prior to conception. Hyperglycemia at conception and during organogenesis increases the risk of spontaneous abortion and major congenital malformations (*Appendix A*). Hyperglycemia reduces fetal oxygenation, and when coupled with maternal acidosis, can lead to fetal demise. Women with type 1 diabetes are prone to diabetic ketoacidosis (DKA) at lower glucose levels.^{4,5} During pregnancy, maternal glycemic control is crucial to prevent fetal hyperinsulinemia associated with excess fetal growth and neonatal complications.

Maternal hypertension and nephropathy are associated with undergrowth of the fetus. Complications for the infant of the diabetic mother (IDM) extend into adulthood whether the infant is overgrown or undergrown.⁶ Infants of diabetic mothers have significantly increased risk for obesity, cardiovascular disease and diabetes.⁷ These challenges led to the development of multidisciplinary patient care programs such as California Diabetes and Pregnancy Program (CDAPP) Sweet Success, to improve specialized care and reduce complications. This chapter is intended to provide best practice recommendations for the medical management and health education of women with preexisting diabetes before, during and after pregnancy.

**GOALS AND
OBJECTIVES OF
PRENATAL CARE
FOR WOMEN WITH
PREEXISTING
DIABETES**

The goals and objectives in caring for women with preexisting diabetes are to reduce maternal and fetal mortality and morbidity and to approximate pregnancy outcomes experienced by the non-diabetic population.

Once pregnancy is confirmed, prenatal care begins. Women with preexisting diabetes are high-risk, and are optimally cared for by professionals experienced in the management of diabetes in pregnancy. Ideally, preexisting diabetic patients have easy access to a tertiary perinatal center, the consultation of a maternal fetal medicine physician, and a multidisciplinary team of certified diabetes educators (a registered dietitian, registered nurse, and behavioral medicine specialist).

The objective of prenatal care is to develop a diabetes treatment plan of care with the woman and team members. This is done by:

- ❖ Identifying, evaluating and treating any long-term diabetic complications
- ❖ Reviewing and achieving glycemic control of A1c $\leq 6\%$
- ❖ Identifying and evaluating self-management skills and educational needs
- ❖ Providing counsel concerning prognosis for a healthy pregnancy
- ❖ Setting expectations for patient participation

The American Association of Diabetes Educators has developed 7 Self-Care Behaviors that serve as a framework for assessment, planning, education needs and help to achieve the goals and objectives of prenatal care.⁸ The AADE 7 Self-Care Behaviors™ listed below⁸ are also addressed in *Chapter 2: Preconception and Interconception Care for Preexisting Diabetes*.

1. Healthy Eating
2. Staying Active
3. Monitoring
4. Taking Medications
5. Problem Solving
6. Reducing Risk
7. Healthy Coping and Living with Diabetes

Healthy Eating

Initial assessment and individualized meal plan by a registered dietitian and follow up each trimester. Refer to the *Chapter 7: Medical Nutrition Therapy* for specific suggestions for evaluating eating patterns and recommending a meal plan.

Staying Active

With medical clearance, women should aim for 30 to 60 minutes of brisk activity daily, such as walking or swimming. Refer to *Chapter 6: Exercise* for specific suggestions for balancing activity and insulin during pregnancy with PDM.

Monitoring

Women with preexisting diabetes should check blood glucose (BG) 8-12 times or more a day, and document food and BG daily. Documentation provides information on how food, exercise and insulin interact in order to improved BG control.^{1,2}

The staff and patient review glycemic control and establish pregnancy targets. Intensive self-monitoring of blood glucose (SMBG) is an integral part of diabetes therapy throughout pregnancy.² In preparation for visits, a food diary and blood glucose record are maintained and utilized to optimize interventions towards tight control. Kitzmiller et al explain that “Fingerstick SMBG is best in pregnancy, since alternate site testing [use of interstitial fluid glucose] may not identify rapid changes in glucose concentrations characteristic of pregnant women with diabetes.”² Daily SMBG, as described in Table 1, will provide crucial information.

Table 1. TARGETS AND SELF-MONITORING OF BLOOD GLUCOSE (SMBG) FOR PREGNANCY WITH PREEXISTING DIABETES^{2,9-13}		
Targets	Frequency	Rationale
<p>Premeal, bedtime, and overnight: 60–99 mg/dL,</p> <p>Peak postprandial glucose 100–129 mg/dL (usually 1hr from first bite of carbohydrate)</p> <p>Mean daily glucose >87 and <110 mg/dL</p> <p>These targets must be individualized to prevent persistent or severe hypoglycemia.</p>	<p>Self-monitoring of blood glucose (SMBG) should occur daily: at the start of meals, after meals, during snacks, before bed and sometimes in the middle of the night (2-4 A.M.).²</p> <p>Consider continuous glucose monitoring (CGM) for certain patients including those with asymptomatic hypoglycemia.²</p> <p>Note that glucose values from CGM (interstitial fluid) lag behind finger stick (capillary) values.</p>	<p>Maternal hyperglycemia increases fetal and maternal mortality and morbidity.</p> <ul style="list-style-type: none"> • Excess birth weight is associated with elevated postprandial glucose levels. • Infants who experience hyperinsulinemia in utero are more likely to develop obesity, HTN and diabetes later in life.¹⁰ • Extremely tight control (mean daily glucose <87 mg/dL) is associated with restricted fetal growth.¹¹ <p>Elevated glucose and rapid normalization, is related to maternal progression of existing retinopathy and nephropathy and an increased frequency of preeclampsia and preterm labor.</p>

Taking Medications

The goal is to ensure that all medications taken are safe and effective for preexisting diabetes. Refer to *Chapter 2: Preconception and Interconception Care for Preexisting Diabetes* for medication alternatives that are safe in pregnancy. Understand insulin administration, storage, expiration and availability of supplies.

Oral medications to lower glucose used by women with type 2 diabetes, such as metformin and glyburide, should not be abruptly stopped before insulin is started. These drugs do not appear to be teratogenic.¹⁴ Hyperglycemia is a teratogen.¹⁵ Some authors encourage continued use of metformin during pregnancy along with insulin, to reduce the dose of insulin, if needed.^{14,16} For women with type 2 diabetes glyburide is generally replaced by insulin. Insulin does not cross the placenta and has established efficacy in maintaining good glycemic control throughout pregnancy.

Insulin Management with Preexisting Diabetes

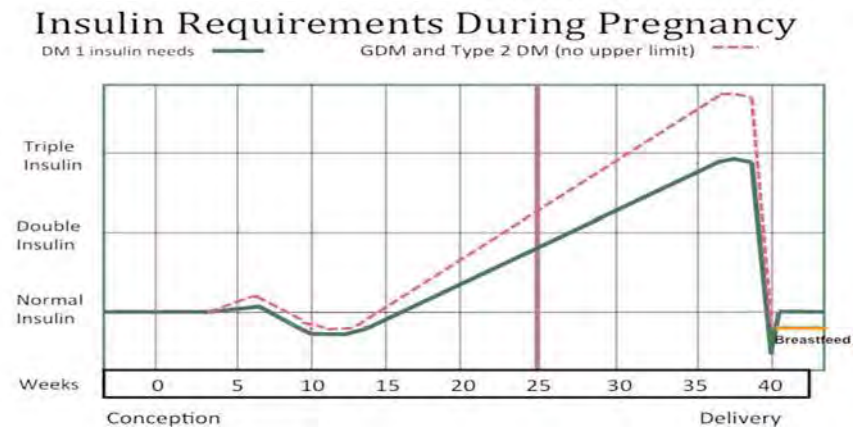
To reduce maternal and fetal mortality and morbidity and to approximate pregnancy outcomes experienced by the general non-diabetic population, tight control of maternal glycemia is essential. Although some women with type 2 diabetes may be able to sustain good control with meal planning and oral medications, most require insulin, as do all women with type 1 diabetes. This section will focus on insulin management for pregnant women with PDM.

Insulin Requirements During Pregnancy

Insulin needs vary throughout pregnancy. Women with type 1 diabetes will generally experience decreased insulin requirements towards the end of the first trimester. This may amount to a reduction of up to 30% in insulin dosage.¹⁷ From the second trimester onward, insulin requirements are expected to increase incrementally until 35 weeks of gestation.² During the second and third trimesters, “insulin requirements are expected to rise sequentially as much as 60-200%.”²

Women with type 2 diabetes may simply have improved BG from weeks 17 on. They may also notice a doubling of insulin doses by the middle of the second trimester and tripling or more, by term. Thus, optimal control of blood glucose will require frequent adjustment of insulin doses for all women either type 1 or type 2 with preexisting diabetes. Figure 1¹⁷⁻²³ is a graph of the changes that occur to the insulin requirements during pregnancy. A large copy is available in *Appendix B*.

Figure 1.



Types of Insulin

Insulin produced by a well-functioning pancreas has essentially two roles: **basal and bolus**.

Basal

The insulin produced for the "basal role" addresses the glucose that the liver is making throughout the entire day and night. This is a constant background/baseline amount and is present whether or not a person eats. Basal insulin make up about 40%-50% of the total daily dose (TDD).²⁴

The most common basal insulin used is NPH, intermediate-acting human insulin, with a peak of 4 hours and a duration of 8 hours. NPH is considered helpful for overnight basal and post absorptive needs although a risk of 3am hypoglycemia does exist. Since the action of NPH increases several hours after injecting, it would seem to be ideal. However the absorption and action of NPH is variable from day to day. Bedtime doses are more predictable when sleeping than daytime doses because activity and stress alter basal needs. Smaller doses are more effective, as larger doses prolong absorption.²⁵

Longer-acting basal insulin analogs such as glargine which lasts 18-24 hours and detemir which lasts 16-23 hours have recently appeared in the literature with small studies showing efficacy and no adverse effects in pregnancy. A large ongoing head-to-head study of detemir and NPH in pregnancy demonstrated that the long-acting insulin analogs have relatively more stable pharmacologic profiles and therefore less hypoglycemia when compared with NPH.²⁶

Bolus

The "bolus role" is the quick burst of insulin that mimics the pancreas' release of insulin in response to a meal. Ideally mealtime insulin doses are matched to carbohydrate intake, pre-meal blood glucose, and anticipated activity, again mimicking the pancreas.^{1,24}

Rapid-acting insulin analogs, lispro and aspart are the preferred “bolus” insulins for use in pregnancy.²⁷ When this insulin is compared to treatment with regular insulin, these analogues show better postprandial control, less hypoglycemia and a trend towards reduction of preterm delivery.^{28,29} Their action begins 5-15 minutes after injection and peaks at 30-90 minutes.²⁹ When taken just before the meal, the peak action of analogs is more likely to meet the peak of glucose absorbed from a meal. Regular insulin must be taken 45 minutes to an hour before eating and peaks 2 hours after injection, and most women fail to wait for the regular insulin to work, resulting in both hyperglycemia and hypoglycemia.

Insulin Regimens and Delivery Systems

Insulin is currently delivered either by Multiple Daily Injections (MDI) or by Continuous Subcutaneous Insulin Infusion (CSII) (insulin pump). Clinical trials of MDI and CSII generally show equivalent glycemic control and pregnancy outcomes.

Kitzmler and associates report that “Both MDI and CSII use the concept of basal and bolus insulin replacement to approximate physiological delivery of insulin during fasting and eating.” They go on to note that “ Tailoring of insulin doses by ‘daily pattern management’ rather than ‘after-the-fact catch up doses’ is recommended because this approach yields smoother glycemic control.”³¹ Split dosing (2/3, 1/3) and “sliding scales” should be avoided during pregnancy as they are generally insufficient for use in intensified therapy.³⁰ The insulin to carbohydrate ratio (ICR) is the grams of carbohydrates that will be metabolized for each unit of insulin. Use of this ratio allows for specific pre-meal insulin dosing based on carbohydrate load.¹ For optimum glycemic control, women with PDM should become proficient in carbohydrate counting and calculate premeal bolus insulin doses based on their ICR and blood glucose. Both methods require adjustments based on patterns, every few days to every 1-2 weeks.

Intensive Multiple Daily Injections (MDI) (pen or syringe)

Intensive MDI requires at least four injections per day: before breakfast, lunch, dinner, and at bedtime. With MDI, long-acting analog or intermediate-acting (NPH) is used for basal insulin and rapid-acting analog before meals (bolus).

Insulin Pens are another convenient method of delivering insulin. They make it possible to use the smallest and thinnest needles available. Pens are especially helpful for a patient with a history of injectable drug abuse. When using insulin syringes, it is advisable to use the 0.5cc syringe. No more than 50 units is given in one site, as more than 50 units has decreased or delayed absorption. The preferred injection site is the abdomen for the most consistent absorption during pregnancy.³¹

The recommended glucose monitoring for insulin regimen is:

- ❖ If using premeal bolus insulin, check blood glucose AM fasting, before and after meals, and at bedtime.
- ❖ If using basal insulin at bedtime, periodically check 3 AM blood glucose.

The ACOG Practice Bulletin on Pregestational Diabetes Mellitus explains that “On average, insulin needs increase from a range of 0.7-0.8 U/kg/d in the first trimester, to 0.8-1 U/kg/d in the second trimester, to 0.9-1.2 U/kg/d in the third trimester.”³² In practice, this often is adjusted over the course of the pregnancy.

Insulin Pump (CSII) During Pregnancy

Multiple programmable basal rates offered by pump-CSII can be especially useful for women experiencing episodes of hypoglycemia or a prominent Dawn Phenomena (increased insulin requirement between 4 and 8 AM).^{22,33} Continuous subcutaneous insulin infusion (CSII) pump therapy has been initiated during pregnancy without a deterioration of glycemic control with positive maternal and perinatal outcomes.

Insulin pumps are programmable to meet the individual’s insulin needs throughout the day. Entering the current premeal blood glucose and the anticipated carbohydrates for the meal into the pump, allows the pump to calculate the appropriate meal bolus, based on current blood glucose, insulin on board from an active bolus, and the carbohydrate content of the meal. The pump automatically corrects to target when calculating the premeal bolus dose. The pump can calculate a correction bolus when blood glucose is above target 2-3 hours after a meal. Only a rapid acting analog is used in pumps, so corrections occur shortly after a correction bolus is given.

Trouble Shooting Hyperglycemia Using the Pump - CSII

If blood glucose is >200mg/dL and a correction insulin dose does not bring it down by at least 30-60 points in two hours, urine ketones are checked. If urine ketones are moderate or severe, an insulin correction bolus is given with a syringe and the pump site and set should be changed. Blood glucose and urine ketones are monitored and the provider called if either glucose remains elevated or ketonuria persists at moderate to severe levels.²⁴

The Problem with CSII

Unfortunately for some women, pumps make insulin dosing so convenient that they may become careless about diet and exercise. Without healthy eating and using problem solving skills, the pump has no advantage over MDI. Malfunction resulting in no insulin delivery can occur increasing the risk for DKA. When using the pump one must attend to alarms and check BG as indicated.²⁴

Problem Solving

Hypoglycemia Prevention and Management

Hypoglycemia can be prevented or managed safely. Refer to Table 10 in *Chapter 2: Preconception and Interconception Care for Preexisting*

Diabetes.

Considerations:

- ❖ Does the patient wear a Medic-Alert® bracelet?
- ❖ Does the woman with type 1 diabetes have someone close to her who knows how and when to use glucagon, and do they have unexpired glucagon available?
- ❖ If using an insulin pump, give a subcutaneous injection correction bolus and change insertion set and insulin and reinsert pump in a new site.

Hypoglycemia is the most common maternal complication occurring in 4.4 - 41.0% of women with insulin-controlled diabetes and is an expected result of intensive glycemic control.^{34,35} The peak incidence of severe hypoglycemia in pregnancy is between 8 to 9 weeks²² and 15 to 16 weeks gestation.¹⁷ Ringholm et al found that in early pregnancy severe hypoglycemia is more common in women with type 1 diabetes. In the third trimester, they found the incidence decreased.³⁶ “Severe” hypoglycemia has been described as a hypoglycemic state which requires the assistance of another individual. This is more common and often more severe in type 1 diabetes, as compared to type 2 diabetes.³⁴

Symptoms of hypoglycemia change during pregnancy making it more difficult to sense low blood glucose levels. Maternal hypoglycemia can be life threatening and risk increases with hypoglycemic unawareness, which is the loss of warning symptoms that previously allowed the patient to recognize the onset of hypoglycemia.³⁵ Refer to Table 2 for indications of hypoglycemia.

Systems affected	Symptoms
Neurogenic (sympathetic nervous system stimulation)	Increased heart rate, sweating, tremors, hunger, tingling in the hands, feet, lips, or tongue
Neuroglycopenic (Deficient brain glucose)	Difficulty thinking, confusion, irritability, seizure, coma, death

Hypoglycemia is not associated with adverse effects on fetal blood flow, heart rate or breathing or measures of intellectual development after birth.^{38,39}

Women and their family and friends that are closest to them are taught strategies to prevent and treat hypoglycemia during pregnancy, including the use of glucagon for the most severe hypoglycemic reactions (loss of consciousness and inability to swallow).³⁷ For information about the administration of Glucagon, refer to the website:

- ✓ <http://pi.lilly.com/us/rglucagon-ppi.pdf>

Hyperglycemia Management

Hyperglycemia is managed safely by the pregnant woman who:

- ❖ Recognizes when BG is above 200 x 2-hours after correction a bolus.
- ❖ When hyperglycemic as above, checks urine ketones and if moderate or large, calls provider.
- ❖ If using an insulin pump, gives a subcutaneous injection correction bolus and changes insertion set and insulin and reinserts pump in a new site.

Conditions that Increase Insulin Needs

Insulin doses must be increased to overcome a reduction in sensitivity for the following conditions:

- ❖ Advanced pregnancy >24 weeks gestation (placental mediated insulin resistance)
- ❖ Obesity BMI ≥ 30 (increased insulin resistance)
- ❖ Stress such as illness (preterm labor, preeclampsia), surgery (Cesarean), psychosocial issues
- ❖ Infection, especially when accompanied by fever, i.e. UTI, pyelonephritis
- ❖ Medications such as betamimetics (terbutaline, ephedrine, epinephrine) or steroids (progesterone, betamethasone, prednisone)

These conditions place a woman with preexisting diabetes at risk for hyperglycemia and potential for ketoacidosis.⁴⁰

Sick Days

The goals of sick day care are to:

- ❖ maintain normal glycemia
- ❖ replace carbohydrate
- ❖ provide adequate hydration
- ❖ prevent diabetic ketoacidosis
- ❖ treat the cause of illness so that sick days are reduced

Sick day management is covered in *Chapter 7: Medical Nutrition Therapy*.

Diabetic Ketoacidosis (DKA) Prevention

The incidence of DKA in pregnancy occurs in 1-3% of patients with preexisting diabetes. The fetal mortality rate during this condition is approximately 9-35%; and the risk of maternal death has been estimated at 5-15%.^{4,5} Although more prevalent in patients with type 1 diabetes, there are case reports of DKA in patients with type 2 diabetes and gestational diabetes. The majority of cases of DKA develop in the second and third trimester and can occur with blood glucose less than 200mg/dL. This condition requires prompt recognition and treatment.⁴ Predisposing and precipitating factors for DKA are listed in Table 3 below.

Table 3. DIABETIC KETOACIDOSIS (DKA)^{1,4,5}	
Predisposing Factors	<ul style="list-style-type: none"> • Decreased buffering capacity (respiratory alkalosis of pregnancy) • Vomiting and dehydration (hyperemesis, gastrointestinal disorder) • “Accelerated starvation” of pregnancy • Increased insulin antagonists (Human Placental Lactogen, prolactin, cortisol) • Stress
Precipitating Events	<ul style="list-style-type: none"> • Poor blood glucose control • Infection • Use of steroids or betamimetics • Omission of insulin doses or CSII failure not recognized and treated • Omission of doses of oral glucose lowering agents • Diabetic gastroparesis • Newly diagnosed type 1 diabetes during pregnancy

Nausea, vomiting, and decreased caloric intake in an otherwise normal pregnant, diabetic woman, require evaluation to identify the cause and exclude ketosis. On rare occasion, DKA has resulted in women with type 1 diabetes when health care providers have withheld insulin due to seemingly normal blood glucose. Insulin should not be withheld for more than a few hours in a patient with type 1 diabetes, even in the presence of normal blood glucose.^{4,5}

DKA profoundly affects both the mother and the fetus. Maternal volume depletion and acidosis leading to decreased uterine blood flow may cause a relative fetal hypoxemia. Glucose and ketones readily cross the placenta, parallel to maternal levels. In the presence of maternal DKA, fetal heart rate changes may occur on a non-stress test such as absence of baseline variability and the presence of late decelerations.⁵

Maternal hypokalemia can cause fetal and maternal cardiac arrhythmias. While carefully monitoring both fetus and mother, the underlying DKA must be corrected. These abnormalities are generally reversible with appropriate aggressive treatment to improve the maternal condition and stabilize the fetal heart rate patterns.

Recommendations for prevention, early identification, and treatment of DKA include the following:

- ❖ Suspect possible DKA when type 1 diabetes women report GI upset such as nausea, vomiting, poor oral intake, or flu-like symptoms.
- ❖ Teach diabetic women to recognize and report these symptoms.
- ❖ Measure urine ketones in the presence of persistent hyperglycemia > 200 mg/dL. If moderate to large urine ketones are present, the woman should notify her provider. The presence of urinary ketones may trigger the need to obtain serum ketone levels as there is a delay of several hours until ketones from the blood appear in the urine. Chronic elevated blood ketones have been implicated in effecting fetal neuropsychomotor

development.

- ❖ Identify and correct the underlying cause of the DKA.⁵

Diabetic ketoacidosis is a critical condition in pregnancy with significant risk of maternal and fetal morbidity and mortality. The patient should be cared for in an acute care unit and in a multidisciplinary fashion including both medicine and obstetric teams as well as neonatology and anesthesia.⁴¹

Reducing Risk

Identify, Evaluate and Treat any Diabetic Complications.

The initial medical evaluation is focused on establishing baseline health status and identifying complications. Table 4 lists the diagnostic tests, the trimesters during which they are obtained, and their rationale.

Table 4. PRENATAL TESTS, EVALUATION AND RATIONALE FOR PREEXISTING DIABETES^{1,2,19}				
Test/Evaluation and Targets	Target 1st Trimester	Target 2nd Trimester	Target 3rd Trimester	Rationale/Risks
Glycemic Control				
Glycemic Control Hemoglobin A1c	A1c ≤6.3%	A1c ≤6%	A1c ≤6%	<ul style="list-style-type: none"> ❖ Turnover of red cells in pregnancy is shortened to <90 days. ❖ An A1c ≤6.3% during organogenesis is associated with decreased risk of birth defects and spontaneous abortion (SAB) to the non-diabetic population incidence rate (1-3%).
Thyroid				
Thyroid Stimulating Hormones (TSH) Thyroid Peroxidase Antibodies (TPO)	<ul style="list-style-type: none"> ❖ TSH >0.03 ≤2.5 mIU/mL ❖ If normal <u>and</u> not being treated, no further testing 	<ul style="list-style-type: none"> ❖ TSH ≤3 mIU/mL ❖ If normal do not retest ❖ Retest if abnormal or being treated 	<ul style="list-style-type: none"> ❖ TSH ≤3 mIU/mL ❖ If normal do not retest ❖ Retest if abnormal or being treated 	<ul style="list-style-type: none"> ❖ TPO antibodies cross the placenta. ❖ Autoimmune thyroid disease is common with type 1 diabetes (35-40%). ❖ Abnormal thyroid function can affect fertility and increase risk of spontaneous abortion.⁴² ❖ Hypothyroid can effect fetal brain development and reduce IQ.
Lipids				
If insulin resistance, obesity and type 2 diabetes a Fasting Lipid Panel is indicated	<ul style="list-style-type: none"> ❖ If indicated LDL ≤100 HDL ≥50 TGs ≤150 	<ul style="list-style-type: none"> ❖ If indicated 	<ul style="list-style-type: none"> ❖ If indicated 	<ul style="list-style-type: none"> ❖ Lipid abnormalities are associated with insulin resistance, obesity and type 2 diabetes. ❖ Statin therapy is contraindicated during pregnancy. ❖ Triglycerides >500mg. increase risk for pancreatitis and fatty liver disease.

Table 4. PRENATAL TESTS, EVALUATION AND RATIONALE FOR PREEXISTING DIABETES , Continued ^{1,2,19}				
Test/Evaluation and Targets	Target 1st Trimester	Target 2nd Trimester	Target 3rd Trimester	Rationale/Risks
Liver Function				
<p>Aspartate Aminotransferase (AST) Alanine Aminotransferase (ALT)</p> <p>Assess for history of fatty liver disease with high BMI and poor glucose control.</p> <p>If liver function tests (LFT) are abnormal consider a liver ultrasound</p>	<p>If indicated</p> <p>Use lab normal</p>	<p>As indicated</p> <p>Use lab normal</p>	<p>As indicated</p> <p>Use lab normal</p>	<ul style="list-style-type: none"> ❖ Fatty liver disease has been associated with late term fetal loss. ❖ During pregnancy, fatty liver disease is treated with dietary and lifestyle change to improve glycemic control. ❖ If LFT is abnormal, consider referral to hepatologist.
Kidney Function (evaluate for potential Nephropathy)				
Serum Creatinine	<1	Repeat if abnormal	Repeat if abnormal	
<p>Nephropathy: Random urine dip for Microalbumin</p> <p>Albumin-to-Creatinine Ratio</p> <p>If at the upper end of normal (25–29 mg) or +1 protein on urine dipstick, obtain a 24-hour urine collection for total protein, creatinine clearance with a serum creatinine</p> <p>Urine C&S if symptomatic for infection</p>	<p>Microalbumin, (≤30 mg is normal)</p> <p>ACR (<9 mg/mmol)</p> <p>Urine dipstick for protein at each OB visit</p> <p>Total protein <300 mg/24 hrs.</p> <p>Perform as indicated</p>	<p>Urine dipstick for protein at each OB visit</p> <p>Repeat 24 hour urine collection if abnormal</p> <p>Perform as needed</p>	<p>Urine dipstick for protein at each OB visit</p> <p>Repeat 24 hour urine collection if abnormal</p> <p>Perform as needed</p>	<ul style="list-style-type: none"> ❖ Nephropathy is associated with increased risk for early preeclampsia and intra-uterine growth restriction (IUGR). ❖ Nephropathy may worsen during pregnancy. ❖ Establish baseline renal function. ❖ Consider Antibiotic Suppression treatment after one infection.

Table 4. PRENATAL TESTS, EVALUATION AND RATIONALE FOR PREEXISTING DIABETES , Continued ^{1,2,19}				
Test/Evaluation and Targets	Target 1st Trimester	Target 2nd Trimester	Target 3rd Trimester	Rationale/Risks
Hypertension				
<p>Blood Pressure (BP) Evaluation Diabetes is associated with increased incidence of gestational hypertension, preeclampsia, and IUGR</p> <p>Consider pharmacologic therapy if SBP>140 or DBP>90</p>	Test BP at each office visit	Test BP at each office visit	Test BP at each office visit	<ul style="list-style-type: none"> ❖ Uncontrolled hypertension is associated with progression of existing retinopathy, nephropathy, preeclampsia and poor fetal growth -intrauterine growth restriction - (IUGR). ❖ Evaluate medications for utilization in pregnancy (refer to <i>Chapter 2: Preconception and Interconception Care for Preexisting Diabetes</i>).
Retinopathy				
<p>Retinal exam by ophthalmologist (dilated retinal exam)</p>	Test	Repeat if abnormal	Repeat if abnormal	<ul style="list-style-type: none"> ❖ Poor glycemic control, rapid change in blood glucoses and hypertension are associated with progression of retinopathy. ❖ Lasertreatment is suggested for pregnant patients ❖ If retinopathy is unstable, an assisted delivery with no valsalva maneuvers may be indicated.
Cardiovascular Disease				
<p>Electrocardiogram (EKG) recommended for: All women with symptoms or significant history; type 2 diabetes; or type 1 diabetes for ≥10 years who have not an EKG within the past year</p>	Test and follow-up as indicated			<ul style="list-style-type: none"> ❖ Risk of coronary heart disease (CHD) is more common in type 2 diabetes, and women with longer history of type 1 diabetes and associated with maternal age ≥35 years. ❖ If cardiovascular disease suspected or identified, refer to cardiologist. ❖ Associated with both maternal and fetal morbidity and mortality, including poor fetal growth, and preterm and assisted deliveries.

Table 4. PRENATAL TESTS, EVALUATION AND RATIONALE FOR PREEXISTING DIABETES , Continued^{1,2,19}				
Test/Evaluation and Targets	Target 1st Trimester	Target 2nd Trimester	Target 3rd Trimester	Rationale/Risks
Neuropathies				
Neuropathy Assessment and treatment is based on symptoms <ul style="list-style-type: none"> ❖ Hypoglycemia awareness ❖ Assess foot care 	Check for history of: <ul style="list-style-type: none"> ❖ Gastroparesis ❖ Orthostatic B/P changes ❖ Hypoglycemia unawareness ❖ Peripheral pain, burning, weakness 			<ul style="list-style-type: none"> ❖ Assess for sensory and autonomic neuropathy as indicated using standard tests. ❖ If hypoglycemia unawareness is identified-modified glucose targets may be indicated. ❖ Gastroparesis, pain, and infection will effect blood glucose control.
Other				
Urine dipstick for Ketones Women are instructed to check urine ketones when BG is >180 for more than 2 hours Ketonuria with hyperglycemia should warrant a call to the provider	Dip urine at each office visit and as indicated			<ul style="list-style-type: none"> ❖ Diagnosis of diabetic ketoacidosis (DKA) is not made on the basis of ketonuria but on the basis of hyperglycemia, ketonemia and low bicarbonate level which is a medical emergency. ❖ Ketoacidosis can develop at lower BG during pregnancy due to accelerated metabolic “starvation.”
Oral health Any woman that has not had regular dental care or shows signs of oral disease or trauma should be referred for a dental examination.	Twice yearly, or as often as recommended by her dentist for examinations, cleaning and protective treatments, such as fluoride and dental sealants.			<ul style="list-style-type: none"> ❖ Periodontal disease is a chronic oral infection associated with difficult glycemic control, inflammation and pregnancy complications such as preterm labor. ❖ Dental treatment is safe during pregnancy.
Celiac Disease: Antibodies to Tissue Serum IgA Endomysial Antibody (IgA EMA) IgA Tissue Transglutaminase Antibody (IgA tTG) If not previously screened-screen all type 1 diabetics, regardless of symptoms	No antibodies is a normal test result If abnormal: <ul style="list-style-type: none"> ❖ Refer to RD for specialized meal plan ❖ Do not biopsy 			<ul style="list-style-type: none"> ❖ Type 1 diabetes has a 4-12% prevalence of celiac disease compared to 1% in the general population. ❖ Celiac disease is an autoimmune disease associated with type 1 diabetes which presents with erratic blood glucose control and mal-absorptive symptoms.

Reduce Fetal Morbidity and Mortality

The fetus in a hyperglycemic environment is at risk for malformations, macrosomia, lung maturity delays, birth trauma (shoulder dystocia, brachial plexus palsy), polyhydramnios and origination of adult metabolic disorders such as obesity, cardiovascular disease and type 2 diabetes.^{20,22} Refer to *Chapter 5: Impact of Maternal Diabetes on Fetal Development and Neonatal Care*.

Maternal tests to determine fetal well-being are described in Table 5.

Weeks Gestation	Test of Fetal Well-Being	Rationale
7-13	Ultrasound	The most accurate measurement for dating is the crown-rump length of the fetus. Ultrasound for dates: crown-rump length (CRL) and for fetal heart activity to confirm viable pregnancy.
18	Ultrasound Anatomy Scan (level 2 ultrasound)	An ultrasound anatomy scan, or level 2 ultrasound, is used to identify birth defects and track growth.
18-before 24	Fetal Echo Cardiogram	Women with PDM should undergo a fetal echo cardiogram at 18-24 weeks gestation because cardiac defects are the most common birth defect related to hyperglycemia. Early detection of abnormalities can ensure adequate preparation for swift treatment of a cardiac defect.
26	If vasculopathy or poor glycemic control, start weekly or twice weekly Non-Stress Testing (NST)/ Amniotic Fluid Index (AFI)	Women with poor glycemic control, high blood pressure, retinopathy, nephropathy or IUGR are at greater risk for poor outcomes and preterm birth, which warrants early antenatal testing by non-stress testing and amniotic fluid index (NST/AFI). If NST is nonreactive BPP (biophysical profile) and Doppler flow studies of umbilical arteries may be warranted. ⁴³
26	Start kick counts	Kick counts are a simple, effective way for the mother to monitor fetal well-being due to an increased risk for fetal death (4-5 fold), particularly in the third trimester. Counting kicks after a meal or in the evening yields the best results. Teach women to report decreased or absent movements ASAP to her provider.
28	Ultrasound for growth	Fetal measurements to estimate size and to evaluate velocity of growth are matched to earlier ultrasounds. An ultrasound done between 28 and 32 weeks gestation showing fetal growth >75%, predicts LGA at term. ⁴⁴ Repeat if indicated.
28	Umbilical artery Doppler studies	Doppler should be performed in women with Intrauterine Growth Restriction (IUGR), hypertension as well as oligohydramnios. ⁴³
32	Antenatal testing (NST/AFI)	Twice weekly or as prescribed for all preexisting diabetes. ⁴⁰
36-38	Ultrasound for estimated fetal weight	This ultrasound can provide information to assess the timing and method of delivery (See Intrapartum section).
<39 weeks planned delivery	Amniocentesis for lung maturity	The hyperglycemic and hyperinsulinemic fetal environment delays surfactant production leading to an increased risk for respiratory distress after 35 weeks. No delay was found if well-controlled. When deliver is <34-35 weeks gestation, betamethasone treatment is used to enhance fetal lung maturity. If an emergent delivery is indicated at <39 weeks, forgo amniocentesis. Poor glycemic control is another indication for delivery prior to 39 weeks.

Healthy Coping and Living with Diabetes

Support women's coping with diabetes and adapting to parenthood by:

- ❖ Developing a plan of care with team members based upon the woman's pregnancy goals
- ❖ Encouraging adequate support systems
- ❖ Assisting her to recognize stress and take steps to reduce it
- ❖ Developing a working relationship with health care team with an emphasis on team dynamics, supportive engagement, good listening skills and motivational interviewing

Develop a plan of care with team members. Kitzmiller et al elaborate further by explaining, "For women with PDM [preexisting diabetes mellitus], feelings of anxiety, guilt, and responsibility are heightened." They go on to say, "Acknowledging steps to make positive changes while encouraging more intensive self-management is vital to establishing a strong patient-clinician relationship."¹

Anticipatory counseling is encouraged during pregnancy so women and their partners are aware of expected changes and issues. Attention should be paid to what the individual feels she can accomplish.

Set expectations for patient participation. Women with preexisting diabetes enter pregnancy with individual approaches to their care. Taking the approach that pregnancy will present unique challenges, (i.e. morning sickness and tight glucose control) may encourage the woman to try some new strategies. Starting with woman's strengths, the provider should maintain a balance supporting autonomy and safety. The behavioral medicine specialist can be pivotal in moving women through barriers to active participation. Refer to *Chapter 9: Behavioral and Psychosocial Components of Care* for more details.

Planning for Labor and Delivery

A delivery plan should be discussed and prepared by the 36th week gestation. This plan is developed with the patient and her partner, and is clearly communicated to the inpatient providers. Delivery should be planned in a facility that can manage the anticipated complexities of diabetes care.

The following information is discussed when formulating the plan⁴⁵:

- ❖ Timing of delivery
- ❖ Method of delivery
- ❖ Pain management
- ❖ When to call OB
- ❖ Blood glucose control and insulin use during labor
- ❖ Management of maternal and fetal intrapartum complications (i.e. shoulder dystocia, labor dystocia, and cesarean delivery)

- ❖ Benefits of breastfeeding to both mother and infant
- ❖ Postpartum follow-up

Intrapartum Management

The goals of intrapartum insulin management are to maintain maternal normoglycemia at 70-110 mg/dL in order to optimize fetal tolerance of labor and prevent neonatal hypoglycemia.

Timing of Delivery

Due to the limited amount of adequate prospective studies, timing of delivery remains disputed. The American College of Obstetricians and Gynecologists (ACOG) and the American Diabetes Association (ADA) do not recommend elective delivery before 39 weeks unless a woman has a clinical indication for preterm delivery.^{1,32,46,47}

Method of Delivery

The method of delivery for women with preexisting diabetes is influenced by clinical and non-clinical factors. Clinically, infants of these mothers weigh more and have greater fat distribution in the trunk and shoulders, which increases the incidence of shoulder dystocia (4.7-11.4%) in vaginal deliveries.¹ However, shoulder dystocia is difficult to predict and preventive cesarean delivery is not an acceptable clinical practice. With large babies, preeclampsia or labor abnormalities, such as active phase arrest, are more common. Fetal hypoxia and acidosis are more common with preeclampsia, vasculopathy and maternal hyperglycemia.¹ Continuous fetal heart rate monitoring is recommended.^{1,32} Morbid obesity in the mother may preclude monitoring the fetus during labor.⁴⁵ ACOG states that "cesarean section may be considered for suspected fetal macrosomia with estimated fetal weights greater than 5,000g in women without diabetes and greater than 4,500g in women with diabetes."⁴⁸ While preexisting diabetes alone is not an indication for cesarean delivery, 30-60 % of these women have cesarean births.¹

Labor and Management of Pain

Ripening the cervix with dinoprostone or misoprostol does not have specific untoward effects with diabetes, however the usual considerations for induction of labor apply.⁴⁷ Pain can cause elevation in stress hormones and an increase in blood glucose. There are no contraindications to epidural anesthesia which is considered the same as it is for nondiabetic women. Epidural anesthesia attenuates catecholamine release during painful labor and may actually improve insulin action to lower blood glucose.⁴⁹ Ephedrine administration to maintain maternal blood pressure may cause a temporary increase in blood glucose for several hours.

There is an association between operative vaginal delivery and an increased risk of shoulder dystocia.⁵⁰ Therefore, before the rare consideration of operative vaginal delivery, proper steps should be taken in anticipation of shoulder dystocia. An anesthesiologist, pediatrician, and well-trained nurses, familiar with the management of shoulder dystocia, should be immediately available. It is important to note that with the increase in obesity, the incidence of shoulder dystocia has increased.

The woman's relationship with her providers and her partner plays a large part in the quality of her coping.

Glycemic Control During Labor

Labor is exercise so blood glucose and insulin requirements may decrease. The target blood glucose range is 70-110 mg/dL with optimum maintenance of blood glucose at about 100 mg/dL.^{32,51,52}

The single most important action to maintain euglycemia during labor is to check the blood glucose frequently. General guidelines to optimize glucose control using Continuous Intravenous Insulin Infusion (CIII) Drip are found below in Tables 6 and 7.

Table 6. CLINICAL ACTIONS TO MAINTAIN MATERNAL EUGLYCEMIA USING CONTINUOUS INTRAVENOUS INSULIN INFUSION (CIII) - DRIP FOR WOMEN WITH PREEXISTING DIABETES^{52,53}
NOTE: For induction of labor in the morning, the usual dose of NPH insulin is given at bedtime the night before but the morning dose of NPH insulin is withheld.
❖ Obtain baseline blood glucose to confirm blood glucose is >70 mg/dL or <110 mg/dL.
❖ In early labor, clear NON CALORIC liquids maybe taken. If carbohydrates are needed, use intravenous dextrose (D5 1/2 NS) as a carbohydrate source, controlled by an infusion device. This equals 5 grams dextrose per 100 mL of 1/2 normal saline. Women with gastroparesis must be NPO throughout labor.
❖ Start main IV with 1000 ml LR at a rate of 50 ml/hr (or 100 ml/hr if not infusing glucose).
❖ Initiate insulin infusion when blood glucose is >70 mg/dL for type 1 diabetes; or blood glucose is 91-110 mg/dL for type 2 diabetes. NOTE: Insulin sticks to the IV tubing therefore, 10-20 ml of the insulin solution must be flushed through the tubing prior to beginning the insulin infusion.
❖ Check blood glucose every 30 minutes until close to 100 mg/dL. Adjust drip dose according to algorithm depicted in Table 7. When blood glucose is stable at 100 mg/dL, BG checks can be done once per hour. Anytime blood glucose is out of the target range it is checked every 15 to 30 minutes.
❖ If blood glucose is <100 mg/dL, begin infusion with 1000 ml D5LR (or D5NS) at 100 ml/hr using an intravenous infusion controller device.
❖ Observe for signs of hypoglycemia and if present, check blood glucose levels immediately. If blood glucose is <70 mg/dL, stop insulin infusion and treat for hypoglycemia (refer to Table 9).
❖ The insulin drip and blood glucose monitoring is continued while the patient is in labor, delivery or undergoing cesarean section.
❖ Following delivery of the infant and placenta, insulin requirements are cut in half. If insulin drip is to be continued postpartum, the algorithm must be cut in half and blood glucose is checked every hour until insulin drip is discontinued.

Table 7 consists of an algorithm for insulin doses during intrapartum and postpartum.

Table 7. CONTINUOUS INTRAVENOUS INSULIN INFUSION (CIII) - DRIP DURING INTRAPARTUM AND POSTPARTUM ALGORITHM FOR WOMEN WITH PREEXISTING DIABETES⁵³		
	INTRAPARTUM	POSTPARTUM
Blood glucose (mg/dL)	Units of insulin in ml/hr	Units of Insulin in ml/hr
	100 units Regular human insulin in 100 ml NS (1ml = 1unit insulin)	
<70 (treat for hypoglycemia)	0	0
71-90	0.5 ml/hr - Start for type 1 diabetes	0
91-110	1 ml/hr - Start for type 2 diabetes	0.5 ml/hr
111-130	2 ml/hr	1 ml/hr
131-150	3 ml/hr	1.5 ml/hr
151-170	4 ml/hr	2 ml/hr
171-190	5 ml/hr	2.5 ml/hr
>190	Assess urine for ketones, Call MD for insulin dose	

With the recommendation of the health care provider, a woman can use her Continuous Subcutaneous Insulin Infusion (CSII) Pump during labor in place of IV drip insulin.⁵⁴ Table 8 lists the general principals of managing CSII-Pump in labor.

Table 8. GENERAL PRINCIPALS OF CONTINUOUS SUBCUTANEOUS INSULIN INFUSION (CSII) - PUMP⁵⁵
❖ For women using the CSII - Pump, basal rates remain the same until uterine activity is regular. When contractions are regular and patient is having clear non-caloric fluids, cut basal insulin rates by 30% of the last pregnancy setting.
❖ Check BG at least every hour and when not in target range, check BG every 30 minutes.
❖ Cut basal rate by 50% of last pregnancy setting, when in active labor.
❖ If Correction Bolus is needed for BG >110 mg/dL, use half the dose and check BG in 30 minutes.

Table 9 addresses treatment of hyperglycemia and hypoglycemia when NPO.

Table 9. TREATING HYPERGLYCEMIA AND HYPOGLYCEMIA WHEN NPO FOR WOMEN WITH PREEXISTING DIABETES^{51,53,56}
Note: Hyperglycemia and Hypoglycemia can be avoided by frequent (no less than hourly) blood glucose checks.
<p>Treating Hyperglycemia Consider source of elevated blood glucose: fever, infection, betamimetics (ephedrine or terbutaline), pain or anxiety, and treat the source. If blood glucose target of 70-110 are not achieved within 2 hours of insulin adjustments, modify IV insulin per the algorithm in Table 7.</p>
<p>Treating Hypoglycemia (Notify physician)⁵³ For blood glucose > 50 to < 70 mg/dL:</p> <ul style="list-style-type: none"> ❖ Stop insulin infusion ❖ Check blood glucose every 15 min until >70 mg/dL x 2; then restart insulin infusion per modified algorithm. <p>For blood glucose < 50mg/dL and patient is conscious:</p> <ul style="list-style-type: none"> ❖ Stop insulin infusion ❖ Increase IV D5 solution to 200 ml/hr until blood glucose is > 70 ❖ Check fingerstick every 15 minutes until blood glucose > 70 times 2; then restart insulin infusion per modified algorithm. <p>For blood glucose < 50 mg/dL and the patient is unconscious:</p> <ul style="list-style-type: none"> ❖ Stop insulin infusion ❖ Carefully consider 50 ml of D50 IV push ❖ Increase D5 solution to 200 ml/hr until blood glucose >70 mg/dL; then restart insulin per modified algorithm. <p>Avoid Glucagon unless the patient is losing consciousness and IV access is lost. Glucagon can cause nausea and vomiting, and it will block insulin for hours allowing the blood glucose to surge above 200 mg/dL. Turn woman on her side.⁵⁶</p>

Cesarean Delivery

When cesarean birth is planned, it is advisable to schedule it in the early morning, avoiding a prolonged fasting period from food and fluid, which complicates insulin management. Women are advised to take their full dose of NPH insulin at bedtime the night before.⁵⁵ The blood glucose is checked upon arrival at the hospital, the fasting target is 80-100 mg/dL.

All women with type 1 diabetes require insulin. Many providers will begin the D5 ½ NS solution when the blood glucose is <130 mg/dL and provide the insulin drip to maintain ~100 mg/dL blood glucose. If the blood glucose goes above 130 mg/dL the glucose infusion can be stopped or reduced to 50 ml/hr and the insulin continued per the algorithm in Table 7 in the postpartum column.^{45,51}

For women with type 2 diabetes, if blood glucose is <100 mg/dL then a glucose-containing IV fluid infusion should be started. One option is D5LR at a rate of 125 m/hr. Some women with type 2 diabetes will need no insulin if their fasting BG is within target and they are not fed or do not require the D5 IV solution.⁴⁵

Continuous Subcutaneous Insulin Infusion (CSII)

Women using an insulin pump who are scheduled for a cesarean birth should maintain the same overnight basal insulin that brings their fasting level to 80-100 mg/dL. Upon arrival at the hospital glucose-containing IV solution should be started, therefore she may not need an adjustment of her basal insulin until after delivery. Initially postpartum there may be an increase in blood glucose due to the stress hormones released in response to surgery, which can last through the two hour recovery period. Blood glucose may be checked every 30 minutes perioperatively due to these rapid changes. It is not necessary to remove the pump for surgery if blood glucose is within target range. If blood glucose is below 80 mg/dL, the pump can be suspended for an hour without adverse effects.

Impact of Cesarean Birth for Women with Preexisting Diabetes

The most common complication related to cesarean birth in women with preexisting diabetes is separation from the baby and delayed breastfeeding. Although some hospitals encourage breastfeeding in the operating room, most do not. This can result in the baby being in the nursery for several hours while the mother is in the recovery room. The delay can be prolonged if the baby has complications. The first hour after birth is the newborns' most alert awake time and this time may pass before breastfeeding is initiated. This can contribute to delayed lactogenesis and newborn hypoglycemia. Every effort should be made to get the couplet together as soon as possible after delivery.

Infection (endometritis and wound break down) is more common in uncontrolled diabetes.⁵⁷ Perioperative antibiotic prophylaxis is effective in reducing the incidence of postoperative fever, endometritis, and wound infections.^{58,59}

Cesarean birth carries a fivefold higher risk of thrombosis compared with vaginal birth in non-diabetic women. There are no controlled studies for women with preexisting diabetes. Thirty-six percent of all Deep Vein Thrombosis (DVT) occurred within the first 6 weeks postpartum. Obesity increases this risk. Studies in non-diabetic women suggest postoperative compression devices provide some preventative benefit.⁶⁰ Heparin prophylaxis may cause heparin induced thrombocytopenia and major bleeding, therefore it is not recommended.⁶¹

**POSTPARTUM
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Postpartum insulin needs are reduced with the delivery of the placenta.⁶² Appropriate adjustments are made as soon as possible to avoid hypoglycemia. To enhance healing and reduce post-surgical complications, hyperglycemia (blood glucose >160 mg/dL) should be avoided.

Glycemic Control after Vaginal Birth

These are the target blood glucose levels following a vaginal birth: premeal and fasting 100-110 mg/dL, and 2 hour postmeal >100, <150-160 mg/dL.⁶²

If women with preexisting diabetes were given insulin IV or by insulin pump during a vaginal birth:

1. Discontinue the insulin drip (CIII) when blood glucose is <140 mg/dL or reset all pump parameters to one-third of the pregnancy dose.
2. Discontinue the dextrose infusion when blood glucose is >80 mg/dL.
3. Provide a meal and give one-half the premeal insulin dose (from pregnancy) for type 2 diabetes and one-third the premeal insulin dose for type 1 diabetes.^{55,62}
4. Alternately, the woman with type 2 diabetes may use metformin and /or glyburide for blood glucose control at their prepregnant doses.^{62,63} Some women with type 2 diabetes may need no medication for a few days to a week after delivery.
5. Women with type 1 diabetes may need smaller insulin doses than before pregnancy and may need no insulin for a short time (24-48 hours).⁶²
6. Blood glucose is checked frequently in the first few days postpartum as insulin needs rapidly change especially with breastfeeding (refer to *Chapter 8: Breastfeeding*).
 - Check blood glucose with vital signs during recovery and on admission to the Postpartum unit.
 - Check blood glucose before breastfeeding and following breastfeeding at night or any time the mother plans a nap after breastfeeding for the first few days. Refer to *Chapter 8: Breastfeeding*.
 - Check blood glucose during fasting, before meals, two hours after meals, at bedtime, and at 3 AM.

Glycemic Control in the Early Postpartum Period^{20,64}

If women with preexisting diabetes were given insulin by IV or insulin pump during a cesarean birth:

- ❖ For type 1 diabetes, continue IV insulin infusion (drip-CIII) at half the algorithm (Table 7) after the delivery of the placenta.
- ❖ For women using an insulin pump (CSII), reset all pump parameters to one third the pregnancy dose when blood glucose is <140 mg/dL.

1. Continue dextrose infusion @ 100 ml/hr or a rate to keep blood glucose <140 mg/dL.
2. Check blood glucose every 1-2 hours while on IV insulin infusion and continue to adjust the dose according to half the labor algorithm.
3. When able to take liquids provide NON-caloric NO-carbohydrate clear liquids such as broth, tea, water and transition to meals as soon as possible.
4. When able to have a meal, discontinue IV dextrose, discontinue IV insulin and give one-half the pregnancy premeal insulin dose for type 2 diabetes and one-third the pregnancy premeal insulin dose for type 1 diabetes.
5. Alternately, the woman with type 2 diabetes may use metformin and /or glyburide for blood glucose control at their pre-pregnant doses. Some women with type 2 diabetes may need no medication for a few days to a week after delivery.
6. Women with type 1 diabetes may need smaller insulin doses than before pregnancy or may need no insulin for a short time (24-48 hours).
7. Blood glucose is checked frequently in the first few days postpartum as insulin needs rapidly change especially with breastfeeding (refer to *Chapter 8: Breastfeeding*).
 - Check blood glucose with vital signs during recovery and on admission to the postpartum unit.
 - Check blood glucose before breastfeeding and following breastfeeding at night or any time the mother plans a nap after breastfeeding for the first few days (refer to *Chapter 8: Breastfeeding*).
 - Check blood glucose during fasting, before meals, one to two hours after meals, at bedtime, and at 3 AM.

**PREEXISTING
DIABETES:
POSTPARTUM SELF
CARE AND
MEDICAL
FOLLOW-UP**

Plans for postpartum and interconception care should begin during pregnancy. Medical follow-up is scheduled two and six weeks postpartum to address early postpartum needs. The postpartum period offers an opportunity for the woman and her healthcare providers to establish an individualized health care plan.⁶² Maximizing BG control during the interconception period is a priority. Delaying pregnancy more than 18 months during this transition period is recommended. Conde-Agudelo et al conducted a meta-analysis between the relationship of birth spacing and negative perinatal outcomes. They concluded that “Interpregnancy intervals shorter than 18 months and longer than 59 months are significantly associated with increased risk of adverse perinatal outcomes.”⁶⁵ With this in mind, select the most effective method of birth control with the least adverse effect on carbohydrate metabolism.

Table 10 addresses recommendations for postpartum self-care and follow-up for women with preexisting diabetes.

Self-Management Behavior	Goal	Rationale
Healthy Eating	<ul style="list-style-type: none"> • Postpartum follow up at 2-6 weeks with RD to reinforce a meal plan that incorporates principals of healthy meal and lifestyle. • Encourage attainment of a healthy BMI. • Adjust meal plan as needed to accommodate breastfeeding needs and weight goals. • Women with celiac disease can be deficient in iron, fat soluble vitamins, B12 and folate. 	<p>Refer to <i>Chapter 7: Medical Nutrition Therapy</i> for specific suggestions for postpartum meal plan recommendations.</p> <p>Refer to <i>Chapter 8: Breastfeeding</i></p>
Staying Active	<ul style="list-style-type: none"> • With medical approval, encourage 30-60 minutes per day of brisk activity, such as walking, swimming, stationary cycling etc. Find an ongoing, long term, enjoyable activity program. 	Refer to <i>Chapter 6: Exercise</i> . Exercise increases insulin sensitivity and may decrease postpartum mood disorders.
Monitoring Blood Glucose	<ul style="list-style-type: none"> • Maintain blood glucose within these targets for postpartum and if breastfeeding: <ul style="list-style-type: none"> ◦ Fasting/premeal <110mg/dL ◦ 2 hour postmeal <150 -170mg/dL • Once blood glucose and medication management are stabilized, check blood glucose fasting, before meals and at bedtime. Post meal testing as indicated. 	Checking blood glucose 3-7 times per day is associated with improved glucose control and fewer complications of diabetes. Strive for A1c of <6% at 3 months postpartum.
Taking Medications	<ul style="list-style-type: none"> • Maintain contact with provider throughout the first 6 weeks postpartum as insulin or oral hypoglycemic medication needs drop or change frequently. • Metformin and glyburide are considered safe for breastfeeding. • Women who utilized antihypertensive therapy or lipid lowering medication, should consult with their physician regarding the medication and breastfeeding. 	Refer to <i>Chapter 8: Breastfeeding</i> .
Problem Solving	<ul style="list-style-type: none"> • Advise the woman to notify the primary physician who provides her diabetes care outside of pregnancy regarding the outcome of her pregnancy and schedule a follow up appointment. 	<p>Inadequate glycemic control in the postpartum period can have immediate and serious consequences such as poor healing, infections or DKA.</p> <p>Prior to delivery advise women with diabetes to see health care providers at 2-6 weeks for postpartum follow up.</p>

Table 10. POSTPARTUM SELF-CARE AND FOLLOW-UP FOR WOMEN WITH PREEXISTING DIABETES Continued^{1,62,66-68}		
Self-Management Behavior	Goal	Rationale
Reducing Risks	<ul style="list-style-type: none"> • Continue normal diabetic care. Obtain A1c, lipids and TSH at 6 months postpartum or sooner if indicated. • Target values^{1,68}: <ul style="list-style-type: none"> o A1c <6% o LDL <100mg/dL o HDL >50 mg/dL o TGs <150mg/dL • Breastfeed for at least 6 months, preferably for 1 year. • Plan future pregnancies: <ul style="list-style-type: none"> o Postpartum begins preconception for future pregnancies. • Plan for adequate birth control. 	<p>Postpartum thyroiditis occurs in 10-23% of women with preexisting diabetes and risk increases for the next year. It is associated with postpartum depression and poor glycemic control, especially with type 1 diabetes.</p> <p>Two years between pregnancies is recommended due to stress on the health status of women from insulin resistance of pregnancy.</p> <p>Most methods of birth control are compatible with uncomplicated preexisting diabetes. Refer to <i>Appendix A</i> in the <i>Chapter 2: Preconception and Interconception Care for Preexisting Diabetes</i>.</p>
Healthy coping	<ul style="list-style-type: none"> • Encourage use of family and social support system (mothers groups etc.). • Assess ability to provide care for self and infant. • Assess with Edinburgh Postnatal Depression Scale at 6 weeks postpartum and again at 3 months postpartum.^{1,66} 	<p>The nature of perinatal mood and anxiety disorders (PMAD) require providers to be able to identify, educate the family, and make appropriate referrals. Refer to <i>Chapter 9: Behavioral and Psychosocial Components to Care</i>.</p>

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Appendices

- A Risk for Major or Minor Congenital Anomaly Based on Periconceptual A1c & Factors That Impact Blood Glucose Levels and A1c Before and During Pregnancy
- B Changes in Insulin Requirements During Pregnancy
- C Suggested Premeal Insulin Correction Algorithm for patients using MDI only – not for pump use

Appendix A**RISK FOR MAJOR OR MINOR CONGENITAL ANOMALY
BASED ON PERICONCEPTIONAL A1c**

The Congenital Anomaly Chart below illustrates that A1c at approximately 2 standard deviations above normal increases the risk for congenital malformations.

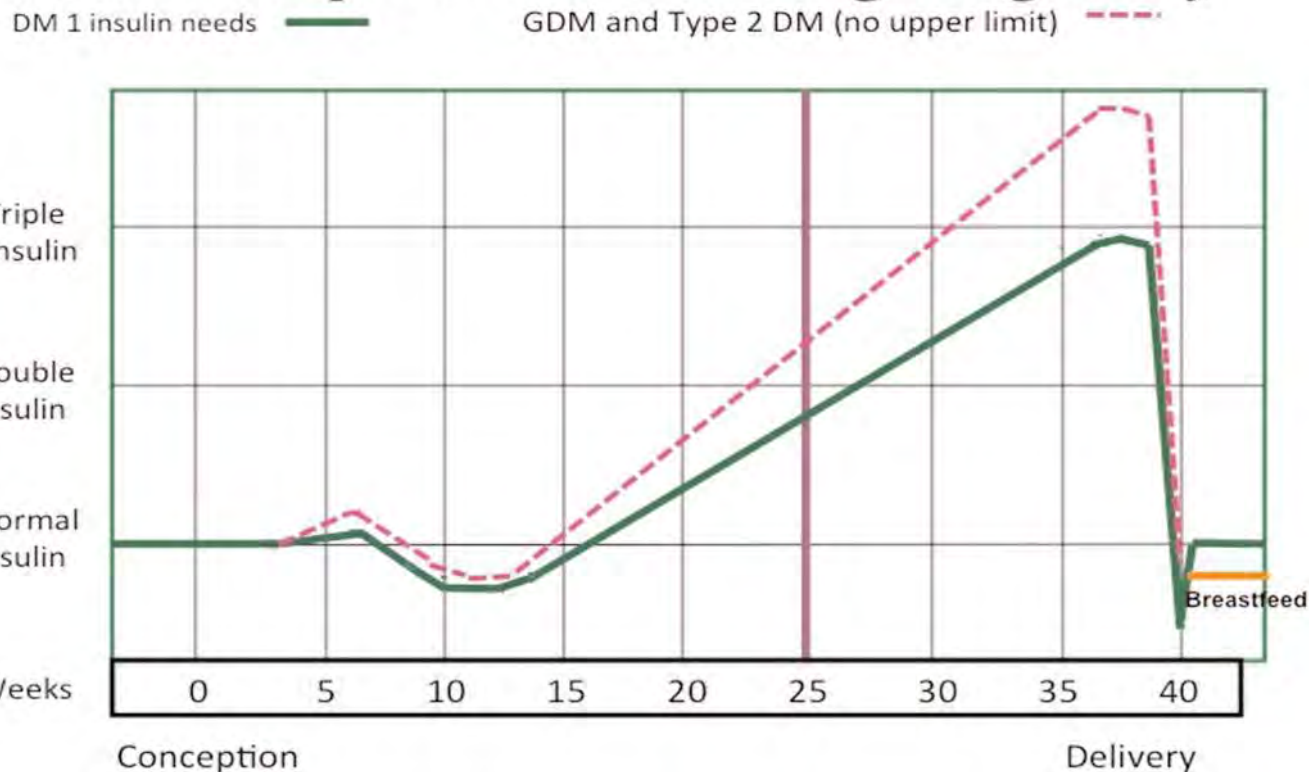
RISK FOR MAJOR OR MINOR CONGENITAL ANOMALY BASED ON PERICONCEPTIONAL A1c⁶⁹													
Standard deviation from mean	0	1	2	3	4	5	6	7	8	9	10	11	≥ 12
Estimated A1c (%)	5.5	6.2	6.9	7.6	8.3	9.0	9.7	10.4	11.1	11.8	12.5	13.2	≥ 13.9
Abnormality risk (%)	2	3	3	4	5	6	7	8	10	12	14	17	20

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Multiple factors can change the A1c results. The table below is a partial list of factors that are often encountered.

FACTORS THAT IMPACT BLOOD GLUCOSE LEVELS AND A1c BEFORE AND DURING PREGNANCY²		
FACTOR	Increased BG/A1c	Decreased BG/A1c
Nausea and vomiting /early pregnancy	X	
Late pregnancy due to increasing insulin resistance	X	
Stress/Sepsis	X	
Timing of BG check in relationship to last meal	X	X
Individual post meal peaks	X	X
Exercise		X Generally
Carbohydrate intake	X	X if restricted severely
↑↑Fat and protein content in meal		X until after time of usual peak BG
Medication (betamethasone, betamimetics) herbs	X Mostly	
Anemia		X
Inappropriate self-care (e.g. over treatment of hypoglycemia)	X	

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Appendix B**Changes in Insulin Requirements During Pregnancy****Insulin Requirements During Pregnancy**

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Appendix C

Suggested Premeal Insulin Correction Algorithm for patients using MDI only – not for pump use

SUGGESTED PREMEAL INSULIN CORRECTION ALGORITHM - MDI		
If BG before meals (breakfast , lunch and dinner) is:	Supplement the dose of premeal rapid acting analog by taking:	And
< 70 mg/dL	2 units less	Eat right away, inject insulin after the meal.
71 - 80 mg/dL	1 unit less	Eat carbohydrate right away.
81 - 99 mg/dL	Take usual/basic dose	Eat right away.
100 - 129 mg/dL	1 unit more	Eat right away.
130 - 159 mg/dL	2 units more	Recheck in 15 min, eat when < 110 mg/dL.
160 - 189 mg/dL	3 units more	Wait 30 minutes to eat if still > 110 mg/dL*.
≥ 190 mg/dL	4 units more	Check CBG every 30 - 60 minutes, eat when near 110*. Check urine ketones.
If BG >200mg/dL, check urine ketones and call provider.		
* Although it is best to wait until BG is in a “normal” range to eat, many pregnant women report this to be difficult. In that case, we recommend eating the non-carbohydrate portion of the meal first.		
This algorithm should be adjusted to make it effective for the individual. This algorithm uses ~30mg/dL correction above a target of a premeal BG of 100mg/dL. Below 80mg/dL insulin sensitivity may increase, therefore, less than the usual dose should be taken.		

Your basic dose of rapid acting premeal insulin is based on your ratio of units of insulin to grams of carbohydrate at each meal. If you have a high or low blood sugar before a meal you need to correct your insulin dose based on your premeal sugar as described above. Insulin works better when your sugar is low or normal; therefore the timing of your insulin dose is also important when trying to achieve good control. Adjust your premeal basic dose based on the correction algorithm.

THIS IS NOT A SLIDING SCALE

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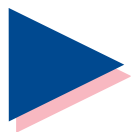
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CDAPP Sweet Success Guidelines for Care

Chapter 4

Medical Management and Education for Gestational Diabetes Mellitus



*Sweet
Success.*

California Diabetes and Pregnancy Program

California Diabetes and Pregnancy Program Sweet Success Guidelines for Care

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4 MEDICAL MANAGEMENT AND EDUCATION FOR GESTATIONAL DIABETES MELLITUS

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4 MEDICAL MANAGEMENT AND EDUCATION FOR GESTATIONAL DIABETES MELLITUS

INTRODUCTION

Glucose intolerance of variable severity that is first recognized during pregnancy is referred to as gestational diabetes mellitus (GDM).¹ New diagnostic criteria allow for the diagnosis of preexisting diabetes at the initial prenatal visit. The American Diabetes Association (ADA) position statement, based on recommendations from the International Association of Diabetes and Pregnancy Study Groups (IADPSG), recommends that a high-risk woman found to have diabetes at her initial prenatal visit should receive a diagnosis of type 2 diabetes and not gestational diabetes.² Based on this, CDAPP Sweet Success has developed the algorithm “Guidelines for Diagnosis of Hyperglycemia in Pregnancy-2011” which includes early detection of GDM (*Appendix A*).

GDM accounts for as high as 90% of all diabetic pregnancies. There is variation in prevalence of GDM at the state level related to differences in rates of risk factors for GDM. In 2008, the estimated prevalence of GDM in California was 5.9% overall with rates as low as 4.7% for non-Hispanic whites and as high as 8.7% for Asians.³ Obesity, unhealthy diet, sedentary lifestyle, improved screening, maternal exposure to high blood glucose levels in-utero, and new diagnostic guidelines have contributed to increasing prevalence of GDM.^{2,4,5}

Table 1^{5,6} lists high risk indicators for an early GDM screen.

RISK ASSESSMENT AND EARLY SCREENING

Table 1. HIGH RISK INDICATORS FOR EARLY SCREEN FOR GDM (First Prenatal Visit)
❖ Overweight or obese
❖ History of GDM in a prior pregnancy
❖ Presence of glucosuria
❖ Diagnosis of Polycystic Ovary Syndrome (PCOS)
❖ Women of ethnic groups with a high prevalence of diabetes: African American, Latino, Native American, Asian American and Pacific Islander
❖ Family history of diabetes (e.g. first degree relative with DM)
❖ Previous delivery of large-for-gestational age infant
❖ Chronic use of medication that may affect blood glucose levels (e.g. steroids, betamimetics, atypical antipsychotics)

According to the International Association of Diabetes and Pregnancy Study Group (IADPSG), the diagnosis criteria of GDM is established when, “any single threshold value on the 75-g, 2-hour OGTT was met or exceeded (fasting value, 92 mg/dL; 1-hour value, 180 mg/dL; and 2-hour value, 153 mg/dL).⁷

The Hyperglycemia and Adverse Pregnancy Outcomes (HAPO) Study illustrated the impact of elevated blood glucose. The study concluded that elevated fasting and 1 hour blood glucose levels were highly correlated with macrosomia, and increased newborn hypoglycemia. A mother’s fasting blood glucose greater than 90 mg/dL is associated with a nearly three-fold increase of macrosomia and a nearly 20% increase in the rate of newborn hypoglycemia.⁸

A major reason we are concerned about early diagnosis of GDM and control of a pregnant woman’s blood sugars is the impact that poorly controlled blood sugar has on her fetus.

Table 2⁵ lists fetal complications and long-term risks to offspring due to poorly controlled maternal blood glucose.

Table 2. FETAL COMPLICATIONS DUE TO POORLY CONTROLLED MATERNAL BLOOD GLUCOSE	
<ul style="list-style-type: none"> • Shoulder dystocia • Other birth injuries • Hypoglycemia • Poor feeding • Hyperbilirubinemia 	<ul style="list-style-type: none"> • Jaundice • Respiratory distress • Polycythemia • Hypocalcemia • Stillbirth

Long- term risks to offspring from poor maternal glycemic control include⁹:

- ❖ Obesity
- ❖ Cardiovascular disease
- ❖ Impaired glucose tolerance
- ❖ Type 2 diabetes

The American Diabetes Association (ADA) recommends using any one of the following 4 criteria for diagnosis of overt diabetes.¹⁰ The first 3 criteria listed have also been adopted by the International Association of Diabetes and Pregnancy Study Group (IADPSG) as criteria for overt diabetes in pregnancy.²

- ❖ HgbA1c \geq 6.5%
- ❖ Fasting blood sugar \geq 126 mg/dL (no caloric intake for 8 hours or more)
- ❖ Random plasma glucose more than 200 mg/dL
- ❖ 2 hour glucose of \geq 200 mg/dL after initiating an oral glucose tolerance test (OGTT) with a 75 gm glucose load (WHO criteria for test)

Some patients may not tolerate an oral glucose load including those with a history of bariatric surgery or hyperemesis. For these women, one option is to have patients monitor fasting and post-prandial blood sugars for a 1-week time period between 24-28 weeks.¹¹

Initial Prenatal Visit

The initial visit for diabetes care while pregnant including¹²:

- ❖ A thorough review of the medical and obstetric history, current condition(s), and medications taken by the pregnant woman.¹³
- ❖ Physical Assessment including:
 - Height
 - Weight
 - Blood pressure during the initial visit and on subsequent visits¹⁴
 - Test urine protein during the initial visit and as indicated, especially if the woman has signs and symptoms of preeclampsia¹⁵

SELF-MONITORING OF BLOOD GLUCOSE (SMBG)

Women who are diagnosed with GDM are taught to periodically self-monitor or test their blood glucose.

Timing of Self-Monitoring

The recommended timing of self-monitoring and blood glucose targets are based on documented results from Continuous Glucose Monitoring Systems (CGMS). These systems found that interstitial glucose in pregnant women peaks within 60-90 minutes of the beginning of the meal.^{16,17} Another study demonstrated that the average peak blood sugar is at the 1 hour mark.¹⁸ Based on this, monitoring at one hour after beginning the meal is preferred, since postmeal glycemic peak values correlate most closely with outcomes such as macrosomia and neonatal hypoglycemia.¹⁹

The blood glucose targets CDAPP Sweet Success aims for are included in Table 3.

Table 3. BLOOD GLUCOSE TARGETS DURING PREGNANCY^{8,20}	
Fasting/Premeal*	60 - 89 mg/dL
Premeal/ Bedtime/ Overnight	60 - 99 mg/dL
Peak postprandial (test at 1 hour from beginning of meal)	100 - 129 mg/dL
Mean daily glucose	>87 mg/dL, <100 mg/dL
* In women with GDM, fasting blood glucose greater than 90 mg/dL was associated with an odds ratio of 2.73 for macrosomia and an odds ratio of 3.62 for c-peptide levels in cord blood at delivery for neonates that had birth weights >90th percentile.	

MEDICATION**Oral Hypoglycemic Agents (OHA)**

When diet and exercise fail to maintain normal blood glucose levels, medication therapy is indicated. Either insulin or oral agents can be used as first-line therapy. There is no specific threshold at which medication should be initiated but some have suggested to do so when >20% of the blood glucose (BG) values in one week are out of range, or BG values are repeatedly elevated at a specific time of day; and meal plan or activity cannot be modified to correct the elevated blood glucose.⁷

While insulin has long been the treatment of choice, new evidence supports the use of OHAs in the management of GDM.^{21,22} Women utilizing OHA should continue diet, exercise, blood glucose testing and receive fetal surveillance as with insulin management.

Glyburide

Glyburide Facts:

- ❖ Second generation sulphonylurea.
- ❖ “First phase insulin response” interacts on the β -cell plasma membrane, allowing immediate insulin release of preformed insulin adjacent to the membrane.
- ❖ “Second phase insulin response” is prolonged as newly formed insulin is moved to the cell membrane from inside the β -cell.²³
- ❖ Hypoglycemia is common with glyburide use.^{23,24}
- ❖ Maximum drug peak in pregnancy occurs 2-4 hours after intake with a prolonged “second stage” response.
- ❖ The glucose peak after a carbohydrate load is 90 minutes.¹⁷
- ❖ Generally, the medication is taken twice daily, 1 hour before meals.
- ❖ Glyburide failure occurs in approximately 20% of patients.^{24,25}

Table 4 describes the Glyburide Protocol.

Table 4. GLYBURIDE PROTOCOL^{26,27}
❖ Begin with 1.25 mg/day (maternal body weight < 200 lbs) or 2.5 mg (maternal body weight \geq 200 lbs).
❖ Administer 60 minutes premeal. Administration closer to the meal may result in symptomatic hypoglycemia 1-2 hours post meal.
❖ To control fasting plasma glucose, glyburide can be given at 10 to 11 PM.
❖ Increase by 1.25 mg to 2.5 mg, every 3-7 days until glycemic targets are met or maximum daily dose of 20 mg.
❖ Teach hypoglycemia prevention and management.
❖ Adhere to MNT meal and snack regimen to avoid hypoglycemia.
❖ Monitor weight as glyburide is associated with weight gain.
❖ Glyburide can be used postpartum.

Please note that not everyone will benefit from the use of glyburide.

Predictors of glyburide failure include:

- ❖ Maternal age (> 34 years)
- ❖ Early diagnosis of GDM (<25 weeks)
- ❖ Higher gravidity and parity
- ❖ Elevated mean fasting blood glucose values²⁸

Metformin

Metformin, another OHA is a biguanide or an insulin sensitizer.

Metformin, with its smaller molecular weight, crosses the placental barrier.²⁹⁻³¹ Among 126 infants of 109 mothers with polycystic ovary syndrome who used metformin at the time they became pregnant and continued to use it throughout their pregnancy, there were no teratogenic affects. These infants had normal height, weight and motor-social development within the first 1.5 years of life.³²

Metformin Facts:

- ❖ Does not cause hypoglycemia³³
- ❖ If women are taking metformin prior to pregnancy or at the first prenatal visit, it is recommended they continue to take metformin^{34,35}
- ❖ Crosses the placenta and crosses into breast milk^{29,33}
- ❖ Metformin utilization is associated with improved fertility and reduced risk of pregnancy loss in the first trimester in women with Polycystic Ovary Syndrome (PCOS)^{33,34}

Table 5 describes the protocol for the use of Metformin.

Table 5. METFORMIN PROTOCOL ^{36,37}
❖ Begin with 500 mg once or twice daily with food, depending on the pattern of hyperglycemia.
❖ Increase dose by 500 mg every 3-7 days as limited by GI side effects until glycemic targets are met or maximum daily dose of 2500 mg.
❖ Obtain serum creatinine at start of therapy if renal dysfunction is suspected. Metformin is cleared in the kidneys.
❖ Drug should be discontinued prior to major surgery, or radiological studies involving contrast materials.
❖ Metformin may be associated with mild weight loss.

Insulin

Hyperglycemia, both fasting and 1-hour postprandial, is positively associated with excess fetal growth and macrosomia. Initiation of insulin therapy should be decided after careful consideration of both fetal growth and maternal glycemic control.

Insulin has been the treatment of choice for pregnant women with diabetes, although there is growing support for the use of oral

hypoglycemic drugs as discussed earlier in this chapter.

The insulin regimen should be tailored to the individual, taking into account the woman's blood glucose levels, lifestyle, food intake, teachability, literacy level, stress level, activity level, and cultural factors.

An option for insulin calculation is in the following table which is modified from a study conducted by Hone and Jovanovic through The Endocrine Society.³⁸ This is recommended in women presenting with blood glucose values higher than or equal to 120 mg/dL fasting and 180 mg/dL postmeal.

Table 6. INSULIN CALCULATION BY GESTATIONAL AGE AND BODY WEIGHT FOR GDM³⁸	
Gestational Age	Insulin Dose
0-12 weeks	0.6-0.7 units per kg actual body weight
13-28 week	0.7-0.8 units per kg actual body weight
29-34 weeks	0.8-0.9 units per kg actual body weight
35-40 weeks	0.9-1 units per kg actual body weight
<p>Instructions</p> <ul style="list-style-type: none"> • Calculate the total daily dose (TDD) of insulin for 24 hours • Divide into 50% mealtime rapid acting insulin analog (bolus) and 50% NPH insulin (basal) <ul style="list-style-type: none"> • Bolus: Divide total bolus into three doses given before breakfast, lunch and dinner • Basal (NPH): Divide total basal into three doses given before breakfast, dinner and bedtime • Adjust based on blood glucose patterns, meal plan and activity, increasing or decreasing insulin by 2 units based on blood glucose findings 1 hour after meals <p><i>Example:</i> A 50 kg woman at 29 weeks gestation has a TDD of 40-45 units (0.8-0.9 units kg x 50 kg = 40-45 units) Divided in equal parts as bolus and basal (20-22.5 units total) Bolus: Divided into three equal parts = 6.6-7.5 units before breakfast, lunch and dinner Basal: Divided into three equal parts = 6.6-7.5 units before breakfast, dinner and bedtime</p>	

Key Points for Initiating Insulin Therapy

Self-monitoring of blood glucose using a blood glucose meter with memory (including date and time) is essential for optimal diabetes management with insulin. It is advised that women with GDM who are taking insulin should monitor blood glucose: AM fasting, premeal, and 1 hour after the start of each meal. Rapid-acting insulin may be increased 1-2 units (or approximately 10%) every 2- 3 days until blood glucose levels are within target range. Review blood glucose results at each visit. Once control is established and premeal blood glucose values

are consistently within target range, monitoring can be reduced to AM fasting, and 1 hour after the start of each meal. The premeal blood glucose testing can be eliminated.

Use a premeal insulin correction algorithm to adjust rapid-acting insulin when premeal blood glucose levels are not within target range. Do not use a post meal sliding scale to adjust insulin, as this practice leads to over treatment and possible fetal exposure to hyperglycemia.

Provide education on the progressive nature of insulin resistance in pregnancy. Initiating insulin must include instruction on insulin injection technique, carbohydrate counting to control postmeal peak glucose levels, and prevention and treatment of hypoglycemia.

If appropriate, teach patients how to self-adjust insulin every two to three days based on glucose patterns. Pattern control is an effective method for insulin self-adjustment. Tailor the insulin regimen to the needs and lifestyle of the patient.

Individuals with GDM and/or obesity in pregnancy are insulin-resistant and often require marked increases in total daily insulin dose. There is no maximum insulin dose. Insulin adjustments may be required every few days, or once a week as insulin needs increase during pregnancy.

Women with GDM may require antepartum hospitalization for similar problems as those impacting women with preexisting diabetes. These may include glycemic control, preeclampsia, pyelonephritis, and preterm labor.³⁹ If medications such as betamimetics or betamethasone are used for preterm labor or preeclampsia, women with GDM on oral hypoglycemic medication or insulin may require, at least temporarily, doubling of their insulin doses. Algorithms for increased insulin needs can be found in *Chapter 3: Medical Management and Education for Preexisting Diabetes During Pregnancy* in the section that addresses antepartum hospitalization for women with preexisting diabetes.

**HELPING WOMEN
PREPARE FOR LABOR
AND DELIVERY**

Table 7 outlines educational issues to discuss in preparation for labor delivery and postpartum. All items should be discussed with the woman and her partner. This education should take place before the 37th week of gestation.

Table 7. LABOR, DELIVERY & POSTPARTUM EDUCATION FOR GDM⁴⁰
❖ Timing of delivery
❖ Intrapartum blood glucose targets and monitoring of blood glucose
❖ Maternal - fetal intrapartum management including potential complications
❖ Newborn management due to diabetes during pregnancy
❖ Reinforcement of benefits of breastfeeding to both mother and infant
❖ Postpartum follow-up and blood glucose retesting
❖ Lifestyle and dietary changes aimed at prevention of diabetes in the future
❖ Planning for future pregnancies

Timing of Delivery

According to American College of Obstetricians and Gynecologists (ACOG), diagnosis of GDM alone is not an indication for delivery prior to 40 weeks gestation. ACOG advises balancing the maternal risks versus those of fetal compromise.⁴¹ Delivery prior to 38 weeks gestation may still be indicated, and the woman should undergo amniocentesis to document fetal pulmonary maturity when feasible.⁴¹

Intrapartum Blood Glucose Control

Intrapartum management of GDM is aimed at maintaining normoglycemia (plasma blood glucose levels of 70-100 mg/dL) during labor and delivery. Elevated maternal blood glucose levels in the last 8 hours before delivery have been associated with neonatal hypoglycemia. Control of maternal blood glucose levels during labor can reduce the incidence of neonatal hypoglycemia, even among women with poor antepartum glycemic control.⁴² Maternal blood glucose concentrations greater than 110 mg/dL – 117 mg/dL increase the incidence of neonatal hypoglycemia.^{43,44} During the active phase of labor, glucose usage increases but slows down after the last component of the active phase is reached. Jovanovic explains that “labor requires very little additional exogenous insulin and appears to mimic the serum insulin concentrations of a trained runner during a marathon.”⁴⁵ Refer to each hospital’s policy and procedure for management of GDM during labor and delivery.

IMMEDIATE POSTPARTUM MANAGEMENT OF GDM

Insulin Management

Insulin needs are reduced postpartum and are generally cut in half. Therapy goal is to keep blood glucose in the following range:
FBG < 100 mg/dL; and 1 hour postprandial < 140 mg/dL

The GDM protocol for the first three days postpartum is included in Table 8.

Table 8. GDM PROTOCOL FOR DAYS 1 - 3 POSTPARTUM	
GDM A1 (diet and exercise controlled)	GDM A2 (requires addition of oral agents and/or insulin for control)
Diet	
When eating: Resume healthy diet using same caloric allotment as pregnancy for breastfeeding. It may be more valuable to evaluate BG with regular diet that patient will be eating at home rather than using a hospital carbohydrate controlled diet.	
Medication	
Glucose lowering medications not needed	<ul style="list-style-type: none"> • There is rarely a need for subcutaneous insulin postpartum. • May consider use of metformin if medication is needed to bring BG into normal range. Metformin use in breastfeeding was found to be efficacious.
Blood Glucose Monitoring	
At least 1 fasting, and 1 one hour after a meal before discharge	FBG and 1 hr after meals for at least 24 hours. If blood glucose remains elevated, continued monitoring is warranted. Consider possibility of type 2 diabetes.
Breastfeeding to Reduce Risk of Type 2 Diabetes	
<p>Breastfeeding has been shown to reduce the risk of type 2 diabetes in the mother and baby whether delivered vaginally or by cesarean section.</p> <ol style="list-style-type: none"> 1. Early (preferably in the first half hour of life) and often (10 -12 times per 24 hours) <ul style="list-style-type: none"> - breastfeeding can reduce the risk of hypoglycemia for the newborn. 2. Provide care (physical assessment and glucose monitoring) needed by couplet without separating them. 3. The newborn's first blood glucose should be obtained after breastfeeding within 30 to 60 minutes of life or earlier when indicated by symptoms in the newborn of low blood sugar. (See Chapter 5: <i>Impact of Maternal Diabetes on Fetal Development & Neonatal Care</i>) 	
Follow up	
Review lifestyle changes aimed at prevention of diabetes in the future and family planning. The need for reclassification of diabetes may be necessary prior to the 6 week postpartum visit when insurance coverage is an issue. Optimally women should be retested in 6 - 12 weeks. Remind patient that a 75 g, 2-hour OGTT is recommended.	

LOOKING TOWARD THE FUTURE

Women with GDM are at increased risk for GDM in future pregnancies and the subsequent development of type 2 diabetes.⁴⁶⁻⁴⁸ In a study of women 6 weeks to 28 years postpartum by Kim et al, it was determined that the cumulative incidence of type 2 diabetes ranged from 2.6% to over 70%. This incidence increased significantly within 5 years post-delivery and tapered off after 10 years.⁴⁹ Research has demonstrated the 2 hour OGTT is more definitive than the fasting plasma glucose in diagnosing Type 2 diabetes in women with a history of GDM.⁵⁰

Table 9 summarized the risk factors for recurring GDM pregnancy.

Table 9. RISK FACTORS FOR RECURRING GDM^{1,46,48}
❖ Obesity
❖ Failure to lose pregnancy weight gain
❖ Failure to maintain normal BMI
❖ Excessive weight gain
❖ Need for insulin during pregnancy
❖ Presence of anti-insulin antibodies
❖ Delivery of macrosomic infant
❖ Diagnosis of IGT or IFG on the postpartum oral glucose tolerance test
❖ Use of progesterone-only contraceptives in breastfeeding women

Women with GDM are at increased risk of developing cardiovascular disease.^{51,52} The offspring of women with GDM, who were large or small for gestational age, are at future risk for cardiovascular disease, obesity and diabetes.⁹ This risk level can be lowered if the mother chooses to breastfeed.⁵³ Well in advance of delivery, education concerning long-term risk reduction should be incorporated during all CDAPP Sweet Success visits.

Monitor Health Status

Women with GDM should be reclassified at 5-12 weeks postpartum using a 75 g, 2-hour OGTT, or an A1c 2-3 months postpartum. At 5-6 years postpartum 15% of women who had GDM will have impaired glucose tolerance or diabetes mellitus.⁵⁴ Lifestyle changes can reduce the rate of conversion to diabetes by up to 58%.^{46,55} Some studies support the use of insulin sensitizers (such as metformin) for beta cell rest, and have shown delay in the progression to type 2 diabetes.^{46,56} Women with a history of GDM have three times the likelihood of developing abnormal lipid profiles and metabolic syndrome^{50 57}

Table 10 summarizes the postpartum recommendations for women with GDM.

Periodically Evaluate Glucose Tolerance	<ul style="list-style-type: none"> ❖ Women with GDM should be screened for diabetes with a 75 g, 2-hour OGTT at 6-12 weeks (before 3 months) postpartum; or after 3 months postpartum. An A1c should be done to determine her diabetic status. ❖ If the screen is normal, repeat at 1 year after delivery and every three years thereafter as long as values remain within normal limits. ❖ Encourage women to obtain a glucose screen before conceiving again. ❖ Subsequent pregnancy should include early prenatal care, risk assessment, and testing for GDM or diabetes with a 2 hr-75 gm OGTT. ❖ If prediabetes, Impaired Glucose Tolerance (IGT) or Impaired Fasting Glucose (IFG) is diagnosed, refer for aggressive lifestyle change. This includes seeing a registered dietitian for medical nutrition therapy; receiving instruction regarding activity and/or evaluation for the need for insulin sensitizer medication such as metformin. ❖ If diabetes is diagnosed postpartum, refer the woman to a diabetic health care provider for follow up and ongoing care.
Evaluate for Metabolic Risk Factors	<ul style="list-style-type: none"> ❖ 1 year after delivery and yearly thereafter. ❖ Follow American Association of Clinical Endocrinologists (AACE) and National Cholesterol Education Program (NCEP) U.S. Preventive Services Task Force (USPSTF) recommendations for testing and evaluation such as lipids, waist-hip ratio, etc.
Coordination of Care	<ul style="list-style-type: none"> ❖ Coordinate care with the primary care provider or obstetrician and the baby's pediatrician. ❖ Notify them of the woman's gestational diabetes and need for continued follow-up. ❖ Refer to a provider familiar with diabetes care who will be vigilant concerning interconception and preconception health concerns for women with previous GDM.

Encourage Healthy Eating

A primary focus of GDM education throughout pregnancy and postpartum is to encourage healthy eating. Women with GDM are given information to empower them to make healthy food choices for themselves and their families. Refer to *Chapter 7: Medical Nutrition Therapy* for additional information.

Breastfeeding provides unique benefits for women with diabetes and their offspring. Refer to *Chapter 8: Breastfeeding* for more information.

Encourage Activity

Research has demonstrated that a physically active lifestyle plays an important role in the prevention of type 2 diabetes. Physical inactivity

postpartum is associated with poor physical function, poor vitality, depressive symptoms, and increased risk of developing Type 2 diabetes.⁵⁸⁻⁶² Refer to *Chapter 6: Exercise* for additional information.

Encourage Problem Solving

Women who have had GDM should be taught to recognize signs and symptoms that are indicative of diabetes. These include increase thirst and urination, repeat vaginal yeast infection or urinary tract infections, unexplained weight loss, blurring of vision, or extreme tiredness. She should space future pregnancies at least 2 years apart and ask their healthcare provider to order a 75 g, 2-hour OGTT or A1c before her next pregnancy. A woman who has had GDM should be screened for hyperglycemia at the first prenatal visit.

Contraceptive Considerations Following a Pregnancy with GDM

Maximizing BG control during the interconception period is a priority. Delaying pregnancy for 2 years during this transition period is recommended. As is similar for women with type 2 diabetes, it is desirable to use the most effective method of birth control with the least adverse effect on carbohydrate metabolism.^{63,64} Refer to *Chapter 2: Preconception and Interconception Care for Preexisting Diabetes* for a review of contraception options.

Monitoring Blood Glucose and Taking other Medications

Prescribed or over-the-counter medications may have detrimental effects on blood glucose tolerance. If an alternative is available that does not adversely affect blood glucose tolerance, it should be considered. This recommendation applies to herbal supplements and vitamins such as niacin.

Encourage Risk Reduction

In the first five years after a pregnancy with GDM, a subsequent pregnancy may increase the conversion to overt diabetes. A pregnancy longer than 5 years after a GDM pregnancy has a slower rate of conversion to type 2 diabetes and plateaus after 10 years. A systematic review by Kim discovered that conversion time from a GDM pregnancy to Type 2 diabetes was relatively similar for different racial groups despite known baseline differences in prevalence.^{46,49}

Women with gestational diabetes are at increased risk of developing cardiovascular disease.^{51,52} Regular physical check-ups including blood pressure, eye, dental and foot examinations is recommended. Encourage smoking cessation. Without adequate follow-up evaluation and testing, type 2 diabetes can go undetected for 7-10 years, during which time cardiovascular damage from elevated blood glucose can be a major problem.

Encourage Healthy Coping

It is important to recognize and treat depression. Depression increases the release of cortisol and other stress hormones resulting in insulin resistance and decreased energy which impacts a woman's activity level. It may also lead to increased non-optimal behaviors such as unhealthy eating or smoking. Depression can interfere with her attachment to her newborn.^{65,66} In addition, assess for sleep deprivation which can increase depression and result in unhealthy coping. Refer to *Chapter 9: Behavioral and Psychosocial Components of Care* for additional information.

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Guidelines for Diagnosis of Hyperglycemia in Pregnancy – 2011

First Prenatal Visit (< 13 wks)*

Many cases of diabetes or abnormal glucose tolerance are not detected until pregnancy. Early detection reduces complications.

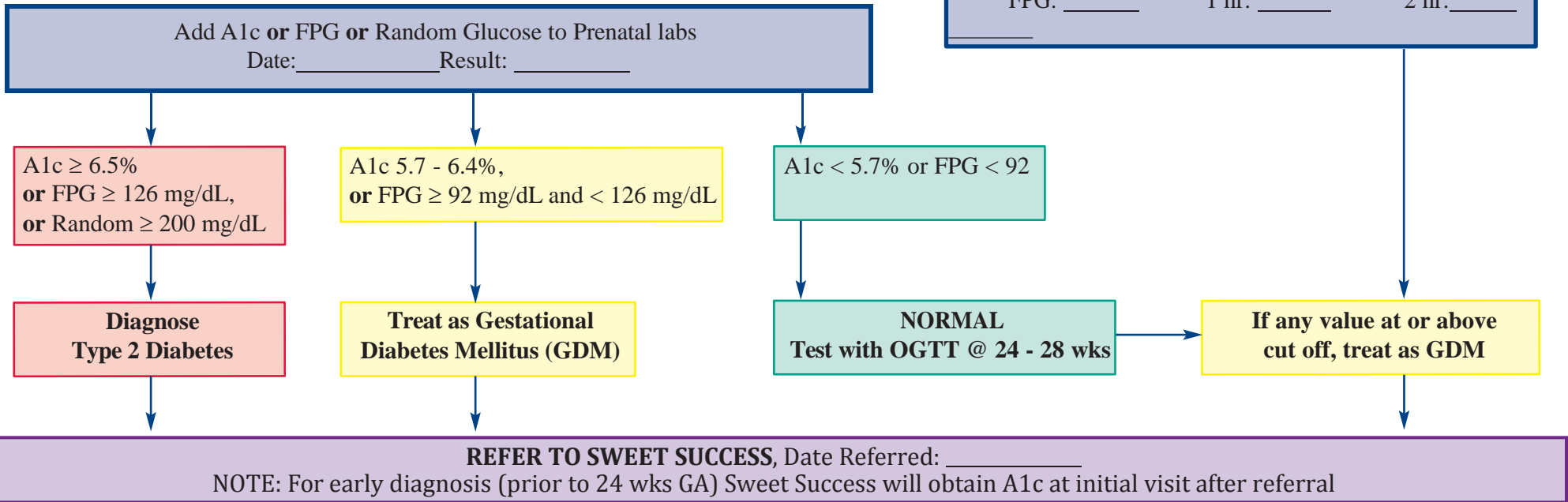
Test: Women who have ANY risk factor:

- Non-Caucasian
- BMI ≥ 25 (at risk BMI may be lower in some ethnic groups)
- History of GDM or pre-diabetes, unexplained stillbirth, malformed infant
- Previous baby 4000 gm or more (8 lbs 13 oz)
- 1st degree relative with DM
- Glucosuria
- Medications that raise glucose (e.g. steroids, betamimetics, atypical antipsychotics)
- Polycystic ovarian syndrome (PCOS), CVD, HTN, hyperlipidemia

ALTERNATE: Test all women for undiagnosed hyperglycemia at the first visit

Universal Testing at 24-28 wks

- 2011 ADA standard is 75 gm 2h OGTT for all women not previously diagnosed with diabetes @ 24-28 wks GA
- Fast 8 - 10 hours, remain seated during test
- Consider adding to third trimester labs



Date: _____
 FPG: _____ 1 hr: _____ 2 hr: _____

*** If entry to care is at 13 - 23 6/7 wks, and risk factors are present, test ASAP with a 75 gm 2h OGTT**



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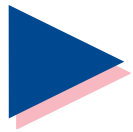
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CDAPP Sweet Success

Guidelines for Care

Chapter 5

Impact of Maternal
Diabetes on Fetal
Development and
Neonatal Care



*Sweet
Success*

California Diabetes and Pregnancy Program

California Diabetes and Pregnancy Program Sweet Success Guidelines for Care

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5 Impact of Maternal Diabetes on Fetal Development and Neonatal Care

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5 Impact of Maternal Diabetes on Fetal Development and Neonatal Care

INTRODUCTION

Advances in the care of pregnant women who have diabetes have improved, but not eliminated, the risk of morbidity and mortality in their infants. Therefore, the newborn care provider must plan and assess for the specific problems frequently encountered by the infant of a woman with diabetes.

An infant of a woman with insulin dependent diabetes has as much as 7.9% higher risk of having congenital malformations than infants born to mothers without diabetes.¹⁻³ Complications vary based on the type of maternal diabetes, type 1 or type 2 diabetes versus Gestational Diabetes Mellitus (GDM) as well as the adequacy of maternal blood glucose control. A 1989 landmark study of 303 insulin-requiring pregnant diabetic women addressed the relationship of first-trimester hemoglobin A1c and spontaneous abortion or major malformations of fetus/infants that progressed beyond the first trimester. Table 1 provides the risk ratios associated with spontaneous abortion and infant major malformations in the presence of poor glycemic control.⁴

hemoglobin A1c (%)	Spontaneous Abortions	Major Malformations for pregnancies beyond the first trimester
≤ 9.3	1.0	1.0
9.4 to 11.0	0.7	1.7
11.1 to 12.7	1.98	1.4
>12.8	>2.9	>12.8

* based on 303 insulin requiring diabetic women. 95% confidence interval.

Recent evidence suggests that women who have mild glucose intolerance [one abnormal value on a 100g Oral Glucose Tolerance Test (OGTT)] have infants with a higher incidence of neonatal obesity than the general population. For these infants, obesity frequently persists into adulthood.⁵⁻⁷ Comorbidities associated with obesity during childhood and adulthood include an increased incidence of metabolic syndrome⁸, hypertension, lipid abnormalities, renal disease⁹, risk of type 2 diabetes¹⁰, and psychomotor, memory and learning deficits.¹¹⁻¹³

The fetus of a woman with impaired glucose control (e.g. pre-diabetes, type 1 diabetes, type 2 diabetes, and GDM) is at higher risk of morbidity and mortality during development and the neonatal period. Associated morbidity includes congenital anomalies, prematurity, perinatal depression, respiratory distress syndrome, and metabolic complications. Although insulin treatment and intensive prenatal and neonatal care have improved outcomes in the offspring of women with type 2 diabetes, this condition contributes to high perinatal mortality due to hyperglycemia-induced teratogenicity. Preconception care with strict glycemic control may significantly reduce hyperglycemia-related mortality and morbidity.¹⁴ Maternal hyperglycemia is associated with an abnormal intrauterine environment. By the eighth week of gestation, diabetic embryopathy (birth defects and spontaneous abortions) may occur. Subsequently, diabetic fetopathy (macrosomia and fetal hyperinsulinemia) occurs during the second and third trimesters.

Table 2: PERINATAL MORTALITY AND NEONATAL MORBIDITY IN INFANTS OF DIABETIC MOTHERS¹⁵⁻¹⁸	
Complications	Reported rates (%)
Perinatal mortality*	0.6 - 4.8
Cesarean delivery*	32 - 45
Premature deliveries <34 weeks gestation	14 - 16
<37 weeks gestation	24 - 33
Congenital anomalies*	1.7 - 9.4
Perinatal asphyxia (fetal distress, low 1-minute Apgar score or intrauterine death*	9 - 28
Macrosomia*	9 - 28
Intrauterine growth restriction	2 - 8
Respiratory distress syndrome	2 - 6
Metabolic complications	
Hypoglycemia**	5 - 25
Hypocalcemia	4
Polycythemia	5 - 33
Hyperbilirubinemia	11 - 29
Cardiomyopathy	
Symptomatic	2 - 10
Asymptomatic	30 - 50
*Lowest rates are associated with strict glycemic control	
**Strong correlation with macrosomia	

**FETAL EFFECTS OF
MATERNAL DIABETES****Diabetic Embryopathy**

Diabetic embryopathy is related to the severity of hyperglycemia.^{19,20} A program of preconception care, strict glycemic control prior to conception and during pregnancy in women with type 1 diabetes may reduce the rate of congenital malformations.^{2,16}

However, Leguizamón et al points out that “Hyperglycemia alone does not offer a complete explanation to the teratogenic process.”²¹ This study looks into “Other factors such as myoinositol and arachidonic acid deficiency, hyperketonemia, and excess of free oxygen radicals.” These indicators were associated with birth defects in diabetic pregnancies.²¹

Diabetic Fetopathy

Diabetic fetopathy, a disease of the fetus after the mother’s third month of pregnancy, results from intermittent maternal hyperglycemia. This results in premature maturation of fetal pancreatic islets, with hypertrophy of the beta cells and resultant hyperinsulinemia (Pedersen hypothesis).²² Macrosomic neonates display significantly more hyperinsulinemia than appropriate for gestational age (AGA) infants.²³

Fetal Growth Patterns

Fetal growth is similar in diabetic and nondiabetic pregnancies during the first and early second trimesters. After 24 weeks’ gestation, maternal hyperglycemia results in disproportionate fat deposition and visceromegaly, while head growth remains normal.²⁴ Insulin can affect certain hormones (e.g. leptin), placental vasculature, and the transport and storage of glucagon in the placenta. The human placenta undergoes change partly due to hyperglycemic insults resulting in altered transport of nutrients such as glucose, amino acids and cytokines, thereby affecting fetal growth.²⁵ Increased growth velocity in the third trimester has been identified in the large for gestational age (LGA) infant of a diabetic mother.

Fetal Hypoxemia

Fetal hypoxemia is a significant contributor to fetopathy in infants of diabetic mothers. Elevated metabolic rate may lead to:

- ❖ Increased oxygen consumption: fetal hypoxemia has been demonstrated in fetal animal models.²⁶ Hypoxemia stimulates erythropoietin synthesis resulting in polycythemia.²⁷ Polycythemia is associated with an increased rate of neonatal jaundice.

- ❖ Nold and Georgieff reported that “Chronic fetal hyperglycemia and hyperinsulinemia can result in glycogen loading of the intraventricular septum,” which leads to fetal cardiomyopathy.²⁸

Macrosomia and Large for Gestational Age

Two terms are used to quantify excessive fetal growth: macrosomia and large for gestational (LGA). A term infant with a birth weight greater than 4,000 grams is considered to have macrosomia. An infant whose birth weight is greater than the birth weight of 90% of infants born at the same gestational age is considered LGA. Excessive fetal growth is documented in the literature as occurring in 20% to 30% of infants of women with diabetes.²⁸

Macrosomia is caused by excessive nutrient supply, which causes increased fetal growth, particularly of insulin-sensitive tissues (liver, muscle, cardiac muscle, and subcutaneous fat).²⁸ Excessive growth is associated with poor maternal glucose control, especially during the third trimester and can be minimized by optimal maternal glycemic control).

Macrosomia is associated with an increased risk of^{29,30}:

- ❖ Cesarean delivery
- ❖ Newborn hyperglycemia
- ❖ Hypoglycemia
- ❖ Birth injury
- ❖ Long-term risk of obesity and diabetes

BIRTH DEFECTS

Congenital Anomalies

As discussed above, infants of diabetic mothers are at significant risk for major congenital anomalies (refer to Table 2 and Table 3).

Congenital anomalies occur in the infant of an insulin-dependent woman with diabetes at rates of two to four times higher than in the general population.¹⁷ A diabetic woman who adheres to a rigid blood glucose control program during the preconception and early pregnancy periods reduces the incidence of congenital anomalies to normal nondiabetic levels.²¹ The systems most commonly affected in the infant of a diabetic mother are cardiovascular, central nervous and neural tube, skeletal, gastrointestinal and genitourinary.¹⁴ Leguizamón et al give guidelines for preconception care that consists of blood glucose control before conception and throughout pregnancy as well as examination into a patient’s history and physical health. They also suggest analyzing potential laboratory determinants due to complications related to diabetes.²¹

Type 1 Diabetes

One study of approximately 8,000 infants found that the relative risk for major malformations in infants of mothers with type 1 diabetes was 7.9 times that of infants of nondiabetic mothers.³ Congenital malformations account for a significant proportion of the perinatal deaths in newborns born to women with type 1 diabetes. Two-thirds of the anomalies in infants of women with type 1 diabetes involve cardiovascular (8.5 per 100 live births) or central nervous system (5.3 per 100 live births). Anencephaly and spina bifida occur 13 and 20 times more frequently in infants of women with type 1 diabetes than in infants of nondiabetic mothers.³

Type 2 Diabetes

Birth defects due to hyperglycemia are also seen in the infants of women with type 2 diabetes. Since birth defects are associated with obesity, women with type 2 diabetes who are also obese may have an increased risk above that based only on hyperglycemia.¹⁵ Watkins et al found that compared with average-weight women, obese women have a higher likelihood to deliver a neonate with heart defects, spina bifida, omphalocele or multiple anomalies.³¹ Table 3 summarizes congenital anomalies associated with infants of diabetic mothers.

Systems	Anomalies
Skeletal	Caudal regression syndrome (sacral agenesis) Hemivertebrae
Cardiovascular	Ventricular septal defect (VSD), patent ductus arteriosus, or atrial septal defect Transposition of the great vessels with or without VSD Coarctation of the aorta with or without VSD Single ventricle, hypoplastic left ventricle Pulmonic stenosis, pulmonary valve atresia, double outlet right ventricle, truncus arteriosus
Gastrointestinal	Duodenal atresia Imperforate anus Anorectal atresia Small left colon syndrome Situs inversus
Genitourinary	Ureteral duplication Renal agenesis Hydronephrosis
Neurologic	Anencephaly, arrhinencephaly Microencephaly, holoprosencephaly Neural tube defects (meningomyelocele and other variants)
Other	Single umbilical artery

**PERINATAL
COMPLICATIONS****Premature Delivery**

Spontaneous premature labor occurs more frequently in diabetic women than in nondiabetic women. Preterm birth rates among women with diabetes vary, depending on the type of maternal diabetes, maternal age, and whether other factors, such as congenital anomalies, are present.^{32,33}

A literature review on premature delivery among diabetic mothers shows the following:

- ❖ Spontaneous Premature labor occurred in 31% of 181 pregnancies among women with type 1 diabetes compared to 7 to 10% in the general population.³³
- ❖ A similar preterm delivery rate of 31% was noted in a study of women with type 2 diabetes.¹⁵

Perinatal Asphyxia

Type 1 diabetes is associated with an increased risk for intrauterine or perinatal asphyxia, which often is defined broadly to include fetal heart rate abnormalities during labor, low Apgar scores, and intrauterine death. In a study of 160 diabetic women, 26% of fetuses had perinatal asphyxia.³³ Perinatal asphyxia was correlated with maternal hyperglycemia during labor³³, prematurity, and nephropathy. Maternal vascular disease, manifested by nephropathy, may contribute to the development of fetal hypoxia, oxidative stress, and subsequent perinatal asphyxia and potential stillbirth.³⁴

Birth Injury

Macrosomia occurs among all classes of diabetic pregnancies, except those with vasculopathy that results in intrauterine growth restriction (IUGR). Macrosomia predisposes the neonate to birth injury, especially shoulder dystocia, and can result in brachial plexus injury, clavicular or humeral fractures, perinatal asphyxia, and less often, cephalohematoma, subdural hemorrhage, or facial palsy.^{35,36} Cesarean delivery without labor often is recommended in diabetic pregnancies if the fetal weight is estimated to be greater than 4300 - 4500g, contributing to the high rate of operative delivery for women with diabetes.³⁵ Ultrasound parameters are not always accurate in predicting macrosomia.³⁵

Intrauterine Growth Restriction

Intrauterine Growth Restriction (IUGR) can occur in poorly controlled diabetes, especially when diabetes is complicated by vasculopathy. Preeclampsia, a frequent complication of diabetic pregnancies, can impair growth by impeding flow of blood and nutrients to the fetus.

Congenital anomalies associated with diabetic pregnancies also may lead to IUGR. Although close control of maternal glucose limits the development of macrosomia, excessively aggressive glucose control may lead to growth restriction.²⁰

NEONATAL DIABETES ASSESSMENT, COMPLICATIONS, AND MANAGEMENT

Neonatal Assessment

Prior to delivery, the health care provider should obtain a maternal-fetal history through chart review and communication with the obstetric care provider and the patient. Review the chart for the following:

- ❖ Outcomes of previous pregnancies
- ❖ Gestational age and estimation of fetal size
- ❖ Control of diabetes preconceptionally and prenatally
- ❖ Results of screening, diagnosis, and treatment of gestational diabetes and genetic evaluations
- ❖ Antenatal fetal surveillance results
- ❖ Monitoring during labor

Optimal management of the infant of a diabetic mother involves the following components:

- ❖ A general neonatal assessment
- ❖ Evaluation for and, if present, treatment of hypoglycemia
- ❖ Assessment and management of diabetes-related neonatal problems
- ❖ Facilitation of family communication and support

Neonatal Complications

Hypoglycemia

Hypoglycemia, defined as blood glucose levels below 40 mg/dL, occurs frequently in infants of diabetic women.²⁸ The onset typically occurs in the first few hours after birth and requires close monitoring. Hypoglycemia is most common in macrosomic infants; this incidence is related to persistent hyperinsulinemia in the newborn after interruption of the intrauterine glucose supply from the mother.²⁸ Strict glycemic control during pregnancy decreases, but does not eradicate, the risk of neonatal hypoglycemia. Preterm infants and infants of women with type 1 diabetes who are SGA are at increased risk of hypoglycemia because glycogen stores are reduced and hyperinsulinemia decreases the ability to mobilize hepatic glycogen.³⁷⁻³⁹

Blood glucose values in the first 2 to 3 hours after birth may drop to low levels and then rapidly and spontaneously improve.^{37,40} Transient low blood glucose levels during this time should be monitored every 15 minutes until recovery is evident. Transient hypoglycemia implies low levels during the 2-3 hours after birth confined to the newborn period. Persistent and recurrent hypoglycemia implies that long-term management is indicated with glucose infusion and/or pharmacological intervention.³⁷

Signs and Symptoms of Infant Hypoglycemia

Symptoms of hypoglycemia are highly variable and can either be present or not. Infants of diabetic mothers encounter hypoglycemia up to 50% of the time, in the early neonatal period.²⁸ A large proportion of hypoglycemic infants will be asymptomatic. Consequently, routine screening is recommended for all infants of women with diabetes. Common symptoms of hypoglycemia in the neonate include^{28,40}:

- ❖ Abnormal cry
- ❖ Apnea
- ❖ Feeding difficulty
- ❖ Lethargy, stupor
- ❖ Hypothermia
- ❖ Respiratory distress
- ❖ Tachycardia
- ❖ Grunting, tachypnea
- ❖ Irritability
- ❖ Hypotonia, limpness
- ❖ Unexplained cyanosis
- ❖ Seizures
- ❖ Jitteriness, tremors
- ❖ Sweating

Recommended Feeding Practices for Asymptomatic Infants

As discussed below, while treatment is needed for the symptomatic neonate, the following feeding practices are recommended for asymptomatic infants who, nevertheless, have blood glucose levels in the hypoglycemic range:

- ❖ Promote early feeding by breast by one hour of age⁴¹, hourly for three or four feedings until the blood glucose is stable (> 40 mg/dL) and then every two to three hours until 12 hours of age.
- ❖ The first colostrum has the highest level of glucose and may be given by spoon when pumped or hand-expressed.
- ❖ Breastfeeding is not contraindicated for hypoglycemic infants. It may require the support of a lactation consultant and supplementation.³⁷ Due to lethargy, feeding difficulties and need for optimal intake, it may be necessary to alternate feeding methods (cup, syringe, gavage) while the mother uses a breast pump to establish and maintain a milk supply.
- ❖ Glucose water is not recommended. It is rapidly absorbed by the gastrointestinal tract and can stimulate the release of insulin, which may further worsen hypoglycemia in the infant of a woman with diabetes.
- ❖ If oral or gavage infant feedings are not tolerated, or the infant blood glucose level drops to 30-40 mg/dL and/or the infant is symptomatic, parenteral treatment may be indicated.⁴²

Treatment for Symptomatic Infants

Facilities should have specific protocols for treatment of infant hypoglycemia. The protocol described below provides recommendations for infants who have hypoglycemia despite feeding, have low birth weight, or are preterm.

- ❖ IV glucose administration is best accomplished with a peripheral IV catheter. However, due to the likelihood and danger of infiltration into the tissues, central access is required if glucose concentrations greater than 12.5% are necessary.
- ❖ Initial treatment includes 2 ml/kg D10W (200 mg/kg/dose) bolus; follow with 4-8 mg glucose/kg/minute (D10W at 80-120 ml/kg/day) infusion.⁴³
- ❖ Do not wait for lab results to verify hypoglycemia and therefore postpone treatment.⁴⁰
- ❖ Measure blood glucose levels every 15 to 30 minutes until glucose is stable and above 40 mg/dL.
- ❖ Observe IV site frequently and treat loss of IV access as an emergency. Reactive hypoglycemia may follow a sudden interruption of glucose infusion.
- ❖ Begin oral feedings if not contraindicated; monitor plasma blood glucose and decrease glucose infusion concentration and rate as tolerated oral feeding volume increases.
- ❖ An infant who requires a high glucose infusion, whose plasma blood glucose drops to less than 20 mg/dL, is unresponsive to treatment, or has sustained hypoglycemia may require a neonatology consult.

Hypocalcemia

Hypocalcemia, defined as a total serum calcium concentration of less than 7 mg/dL, or an ionized calcium value of less than 4 mg/dL, or less than 3.2 mg/dL in infants with birth weight less than 1500 g, occurs in at least 10% to 20% of infants of women with diabetes. The lowest serum calcium concentration typically occurs between 24 and 72 hours after birth and often is associated with hypomagnesemia. The extent of hypocalcemia is related to the severity and duration of maternal diabetes.²⁸

Hypocalcemia is thought to be caused by the lower concentration of parathyroid hormone (PTH) after birth that is observed in neonates of diabetic mothers.⁴⁴ Higher serum ionized calcium concentrations in utero may suppress the fetal parathyroid glands. The development of hypomagnesemia, prematurity, and birth asphyxia may be contributing factors.⁴⁴ Hypocalcemia usually is asymptomatic and resolves without treatment in term infants of diabetic mothers. As a result, routine screening is not recommended. However, the serum calcium concentration should be measured in infants with:

- ❖ Jitteriness
- ❖ Lethargy
- ❖ Apnea
- ❖ Tachypnea
- ❖ Seizures

and in infants who have the following complications:

- ❖ Prematurity
- ❖ Asphyxia
- ❖ Respiratory distress
- ❖ Suspected infection

Hypomagnesemia

When serum magnesium concentration is less than or equal to 1.5 mg/dL hypomagnesemia occurs. Hypomagnesemia appears within the first three days after birth in up to half of pregnancies complicated by diabetes.^{28,45} The mechanism is thought to be maternal hypomagnesemia, caused by increased urinary loss secondary to diabetes.^{28,45} Prematurity may also be a contributing factor. Hypomagnesemia usually is transient and asymptomatic, and thus usually is not treated. However, hypomagnesemia can reduce both parathyroid hormone (PTH) secretion.⁴⁶ As a result, in some neonates with hypocalcemia and hypomagnesemia, the hypocalcemia may not respond to treatment until the hypomagnesemia is corrected.

Respiratory Distress Syndrome

Respiratory distress syndrome (RDS) occurs more frequently in infants of diabetic women in comparison to infants of nondiabetic mothers. This is especially significant in infants born before 38 weeks with suboptimal glycemic control or poor gestational dating.^{47,48} The mechanism may be delayed maturation of surfactant synthesis caused by hyperinsulinemia, possibly by interference with the induction of lung maturation by glucocorticoids.^{47,49} In contrast, fetal lung maturation may occur early in diabetic pregnancies stressed by vasculopathy.

Respiratory distress may also be due to hypertrophic cardiomyopathy⁵⁰, other cardiac or pulmonary anomalies, or transient tachypnea of the newborn (TTN).^{51,52} Respiratory distress increases the work of breathing and glucose utilization, and warrants diagnostic evaluation and early treatment.

Transient Tachypnea of the Newborn

Transient tachypnea of the newborn (TTN) is the most common cause of respiratory distress in the term infant of a woman with diabetes. TTN occurs two to three times more commonly in these infants compared with infants of nondiabetic mothers.⁵³ The newborn will exhibit tachypnea within the first two hours of birth.⁵⁴ This condition develops as a result of residual fetal lung fluid following delivery, is mostly benign, and will usually resolve within a few hours or within two days following delivery.⁵⁴ Cesarean delivery for fetal macrosomia increases the risk of developing TTN.⁵⁵

Polycythemia and Hyperviscosity Syndrome

Polycythemia is characterized as a central venous hematocrit of more than 65%.^{28,51,56} Symptoms include:

- ❖ Poor feeding
- ❖ Tachypnea
- ❖ Plethora
- ❖ Lethargy
- ❖ Cyanosis
- ❖ Irritability
- ❖ Respiratory distress

- ❖ Hyperbilirubinemia
- ❖ Hypoglycemia
- ❖ Thrombocytopenia

The mechanism for polycythemia is uncertain, but is related to increased erythropoietin concentrations caused by chronic fetal hypoxemia.⁵⁷

Polycythemia may lead to hyperviscosity syndrome, which can include ischemia, and infarction of vital organs. Hyperviscosity is thought to contribute to renal vein thrombosis seen in infants of diabetic mothers. Polycythemia may also contribute to rare occurrence of stroke, seizures, necrotizing enterocolitis, and renal failure.^{28,56} The hematocrit should be measured within 12 hours of birth to detect polycythemia. Treatment recommendations for infants with polycythemia depend on whether the infant is symptomatic.²⁸

Hyperbilirubinemia

Hyperbilirubinemia occurs in 25 to 50% of infants of diabetic women.⁴⁶ It is associated with poor maternal glycemic control, and macrosomic infants are at highest risk.⁵⁸ Increased red blood cell production secondary to increased erythropoietin results in increased breakdown of red blood cells and an increase in bilirubin production. The relative immaturity of hepatic bilirubin conjugation and excretion contributes to this process. In addition, the excess hemolysis may result from glycosylation of erythrocyte membranes. Polycythemia and prematurity are contributing factors.

Large for gestational age infants of diabetic mothers may be at a greater risk for hyperbilirubinemia.¹⁸ In a study conducted by Peevy et al, “Peak serum bilirubin concentrations were also significantly higher in LGA IDM [large for gestational age infants of diabetic mothers] than in AGA IDM [appropriate for gestational age infants of diabetic mothers] or control infants.”¹⁸

Diagnosis and treatment depend not only on measured bilirubin levels, but also on the age and condition of the infant. Infants born to mothers with well-controlled diabetes appear to have fewer problems with hyperbilirubinemia.

Hypertrophic Cardiomyopathy

Hypertrophic Cardiomyopathy is one of the most commonly reported cardiac malformations and is characterized as a thickening of the heart muscle. It is thought to be caused by fetal hyperinsulinemia leading to an accelerated growth of cardiac cells.^{59,60} It is most likely to occur in mothers with poor glycemic control during pregnancy although it has still been found in infants of diabetic mothers who have great glycemic control. These changes have been reported to occur in up to 30% of all infants of diabetic mothers.⁶⁰⁻⁶² In the fetus of women with pre-existing diabetes, cardiac function changes are evident in the first trimester and cardiac enlargement in the third trimester.⁶³

Diagnosis is best made by echocardiogram. This condition is transient and rapidly resolves as insulin concentrations normalize.^{28,60} The newborn is often asymptomatic. However, some infants will exhibit congestive cardiac failure and there have been a few fetal deaths reported in the literature.⁶²⁻⁶⁴

Signs and symptoms of hypertrophic cardiomyopathy and congestive heart failure include:

- ❖ Tachycardia
- ❖ Tachypnea
- ❖ Decreased heart rate with poor variability
- ❖ Poor peripheral perfusion
- ❖ Systolic ejection murmur
- ❖ Lethargy
- ❖ Fast, heavy breathing and sweating during feedings

Symptomatic infants typically recover after two to three weeks of supportive care and echocardiogram findings resolve within 6 to 12 months.^{64,65} Supportive care includes intravenous fluid administration, ventilatory support, correction of any metabolic conditions, and beta-blockers.²⁸

Small Left Colon Syndrome

Small left colon syndrome presents with abdominal distention, failure to pass meconium, and bile-stained vomiting.²⁸ The problem is transient and usually resolves after the evacuation of the colon.⁶⁶ Diagnosis is made with water-soluble contrast enema radiographic studies⁶⁶, which often results in the passage of meconium and is thus therapeutic. However, glycerin suppositories may be needed for the first few weeks of life.

Renal Vein Thrombosis

The incidence of renal vein thrombosis is increased in the infant of a woman with diabetes, but remains rare. If it is not identified on a prenatal ultrasound, the presence of newborn hematuria, hypertension and/or a flank mass requires further investigation.²⁸ This complication usually resolves with conservative and supportive management that includes careful fluid and electrolyte management to treat any hypertension.²⁸ Subspecialty consultation is recommended.

**POSTNEONATAL
COMPLICATIONS/
LONG-TERM
SEQUELAE****Risk of Developing Diabetes**

Children of mothers with diabetes have an increased risk of developing diabetes that is, in part, genetically determined.^{30,67} The lifelong risk of developing diabetes is difficult to quantify and multifactorial. Rates may be up to 6% in singleton offspring of diabetics, and 33% in their identical twins (versus 0.4% in subjects with no family history).⁶⁸

The abnormal metabolic environment of a diabetic pregnancy affects the development of type 2 diabetes and predisposing risk factors such as obesity.^{8,30,67,69} The prevalence of both type 2 diabetes and obesity has increased via a “vicious cycle” - a greater likelihood of diabetes in the mother increases the likelihood of diabetes in the offspring.^{30,70,71} Intrauterine exposure to hyperglycemia and hyperinsulinemia affects the development of adipose tissue and pancreatic beta cells, leading to future obesity and altered glucose metabolism.³⁰ Macrosomia at birth resolves by one year of age, but obesity recurs in childhood, resulting in a greater body mass index in offspring of diabetic mothers than controls. Impaired glucose tolerance has been documented in 36% of offspring of diabetic mothers, an abnormality associated with elevated amniotic fluid insulin concentrations.⁷² An increased incidence of high body mass index at 4 - 7 years of age has been noted in macrosomic offspring of mothers with gestational diabetes.⁷³

Several studies have shown that metabolic syndrome, which consists of insulin resistance, hypertension, obesity, and dyslipidemia, has increased in the offspring of women with diabetes. In one study, the incidence of metabolic syndrome seen at 11 years of age in the LGA offspring of women with GDM was 50%, however it was only 21% in the average weight offspring of women with GDM, and 4.8% in the average weight offspring of nondiabetic mothers.⁸

The studies mentioned in this section raise the issue of working with women to control their blood glucose levels and their infants' birth weights. Healthcare practitioners should encourage women to provide an environment and lifestyle that will prevent or reduce obesity, diabetes, and metabolic syndrome in their families. Lifestyle modifications that are encouraged for women after a GDM pregnancy include exclusive breastfeeding, physical activity, and healthy nutrition.^{74,75}

Neurodevelopmental Outcomes

Studies on long-term neurodevelopmental outcomes have appeared in the literature since 1960, but research has been sporadic and has often used animal models. The neurodevelopmental outcomes of infants of women with well-controlled diabetes are similar to those of normal infants.^{11,13,76,77} In contrast, poorly controlled diabetes may result in neurodevelopmental abnormalities in the offspring.^{13,78}

In one study, for example, head circumference at three years of age was negatively correlated with A1c levels during pregnancy.^{13,77,78} In another study of 196 offspring of women with type 1 diabetes, psychomotor development at 6 - 9 years of age correlated with maternal ketone concentrations during the second and third trimesters.¹¹ IUGR and central nervous system damage and malformations also contribute to developmental delays.

**FACILITATION OF
FAMILY
COMMUNICATION
AND SUPPORT**

Psychological Impact of Abnormal Fetal Imaging and Parental Response

Conveying abnormal prenatal ultrasound findings to concerned parents is a difficult task and requires provider skill. Abnormal test results confront parents with life-altering decisions about anomalies that are either incompatible with life or will irrevocably alter their child's and their family's future.

When confronted with the discovery of a fetal abnormality, expectant parents are faced with acute emotional trauma that can threaten their own functioning ability at the time, their developing role as parents, and their attachment to their future child. Prenatal diagnosis of malformations is the most ethical medical practice although it does cause parents more psychological distress than postnatal diagnosis despite having more time to adjust.^{79,80} Research has found that prenatal diagnosis was a significant predictor of acute psychological distress in parents, especially among mothers who were being admitted to a tertiary care center.^{79,81} As a result, the remainder of the pregnancy can be fraught with underlying anxiety and uncertainty for parents as they struggle with perceived loss of control.

When parents decide to continue with the pregnancy, they will seek ongoing support from health care professionals who respect their choice and help them maintain both a sense of hopefulness and normalcy. Fear of healthcare professionals rejecting their choice is common. Parents experience much relief when their decisions are met with acceptance and respect.⁸¹

When women are faced with results showing fetal abnormalities in an intended pregnancy and decide to terminate their pregnancy, their bereavement is very similar to women who experience spontaneous pregnancy loss.⁸² Bereavement is often confounded by the choice involved, ambivalent feelings about screening, abortion, and disability.

Guidelines for Counseling Parents Facing Abnormal Prenatal Ultrasound Findings

- ❖ Provide the critical information of the ultrasound results with empathy and understanding for the parents' stress response and grief process.
- ❖ Coordinate timely visits with the tertiary care center team (perinatologist, social worker, etc.) to ensure continuity of care for parents.
- ❖ Respect the parents' decision and offer nonjudgmental support if termination of pregnancy is an option.⁸¹
- ❖ Attend to and validate the complexity of parents' reactions and emotional responses.
- ❖ Assess available social support services and offer resources appropriate to the family's needs.
- ❖ Provide appropriate referral to a mental health professional as needed.

Guidelines for Counseling Parents of Infants with Abnormalities During the Postnatal Period

While caring for the infant with abnormalities, keep these maternal and family-related issues in mind:

- ❖ Anticipatory guidance pertaining to a known problem may decrease maternal and familial anxiety. This can include a visit to a NICU, if the mother expresses an interest.
- ❖ The woman who has a newborn with medical problems has an increased need for psychosocial support. If the baby is in the NICU, she may be frustrated about barriers between her and the baby and experience depression associated with her perceived helplessness and limited or lack of opportunity to bond with the baby. All of these feelings may occur in the father as well as in extended family members. The stress of having an infant in the NICU can exacerbate already strained relationships, which can magnify the mother's anxiety, depression and hopelessness.
- ❖ Even if the newborn is relatively well, the mother will need additional reassurance and support to resolve the stress associated with her pregnancy.
- ❖ A mother with diabetes is particularly vulnerable during the postpartum period. She has just experienced a high risk pregnancy, is coping with a chronic illness, and has a newborn who requires special medical attention.
- ❖ Women and families from other cultures may have different beliefs about the causes of diabetes, the implications of the mother having diabetes, and the impact of this illness on her baby. The woman and her family may require special counseling from a staff person who understands and can relate to diverse cultural beliefs. Refer to *Chapter 10: Cultural Competency* for additional information.

- ❖ Support for breastfeeding, if the infant's condition permits, should be provided. Refer to *Chapter 8: Breastfeeding* of this manual for more information.

Refer to *Chapter 9: Behavioral and Psychosocial Components of Care* of this manual for more complete information on psychosocial evaluation and intervention.

Counseling Parents about the Newborn's Diabetes Risk

Diabetes is a unique chronic illness where the majority of care and responsibility occurs in the home. The family as a whole, rather than healthcare professionals, is the “management team” of the disease. Adhering to a philosophy of diabetes as a family disease is often useful when counseling parents about an increased risk for diabetes in their newborn.⁸³ It is important to increase the family's overall understanding about lifestyle changes that benefit both the children and adults. The family is seen as the focus of intervention with comprehensive education about behavioral changes that positively influence glycemic control.⁸³ Care coordination with the family's pediatrician is another preventive measure with long-term positive implications for disease management.

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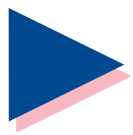
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CDAPP Sweet Success Guidelines for Care

Chapter 6

Exercise



*Sweet
Success.*

California Diabetes and Pregnancy Program

California Diabetes and Pregnancy Program Sweet Success Guidelines for Care

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6 Exercise

INTRODUCTION

Regular physical activity should be an important part of every woman's lifestyle.^{1,2} Although the physiologic changes that occur during pregnancy may limit some types of exercise activities, low-to-moderate intensity exercise is safe and beneficial. Exercise during pregnancy helps maintain cardio-respiratory and muscular fitness, may help decrease stress, and may alleviate some symptoms of depression.

Exercise provides an additional benefit for pregnant women who have diabetes as it also helps to lower blood glucose.³ Regular, aerobic activity can be a useful tool for improving glycemic control by increasing insulin sensitivity.^{4,5} Therefore, the addition of or change in an exercise program to a woman's self-management plan may affect other aspects of her self-management strategy, such as her meal plan and insulin regimen.

BENEFITS AND POTENTIAL RISKS OF EXERCISE

Table 1 summarizes both maternal and fetal benefits and potential risks of pregnancy.

	Benefits	Potential Risks
Maternal	<ul style="list-style-type: none"> • Increases insulin sensitivity^{6,7} • Increases glucose utilization⁵ • Improves carbohydrate utilization⁶ • Increases and maintains muscular strength⁷ • Increases and maintains cardiovascular conditioning^{4,7,8} • Facilitates recovery⁸ • Augments a general sense of well-being^{1,4,8,9} • Fosters positive behavior and lifestyle changes⁶ • Reduces back pain⁸ • Improves mild to moderate hypertension⁷ • May prevent excess weight gain⁸ • Reduces risk of preeclampsia^{10,11} 	<ul style="list-style-type: none"> • Increases hypoglycemia^{4,8} • Blood pressure increases may exacerbate preexisting long term complications⁷ • Potential for musculoskeletal injuries^{7,8} • Increases preterm labor in those with a history of preterm births³
Fetal	<ul style="list-style-type: none"> • May reduce the risk of delivery of LGA due to GDM¹² 	<ul style="list-style-type: none"> • Increases fetal bradycardia¹³

**PHYSIOLOGICAL
CHANGES DURING
PREGNANCY AND
EXERCISE**

Pregnancy induces a number of cardiovascular, metabolic, musculoskeletal, and thermoregulatory changes.

Cardiovascular Changes

Cardiovascular changes that occur during pregnancy include^{8,13,14}:

- ❖ Increased blood volume - blood volume increases progressively starting at 6-8 weeks gestation and reaches a maximum at 32-34 weeks. The average increase in volume at term is 45 - 50%. The increase is needed for extra blood flow to the uterus, extra metabolic needs of the fetus, and increased perfusion of other organs, especially kidneys.
- ❖ Increased stroke volume - the amount of blood pumped by the left ventricle of the heart in one contraction.
- ❖ Decreased systemic vascular resistance - decrease in the resistance the left ventricle must overcome to pump blood through the systemic circulation.
- ❖ Increased cardiac output- cardiac output increases approximately 40% during pregnancy (reaching a maximum at 20- 24 weeks gestation). Cardiac output is very sensitive to changes in body position. This sensitivity increases as pregnancy progresses, presumably because the uterus impinges on the inferior vena cava.

Cardiovascular changes are also influenced by body position. Several studies indicate that the supine position is associated with decreased cardiac output in most pregnant women. Therefore, pregnant women should avoid the supine position in the second and third trimesters in times of physical activity and rest.¹³

❖ **Maternal Blood Flow Changes**

A number of the maternal blood flow changes that occur during pregnancy are exacerbated during exercise. These include a dramatic shift in blood flow due to shunting of blood away from the organs of the gut, including the uterus, to the working muscles, skin and kidneys. These changes are influenced by body position. There is a decrease in total uterine blood flow⁸, a fall in systemic vascular resistance by 8 weeks.¹⁵ Furthermore, several studies indicate supine positioning reduces venous return from the hip to the toes¹⁵ and is associated with decreased cardiac output in most pregnant women.

For a woman with preexisting diabetes, identifying any vascular disease, hypertension, or other complications that may compromise maternal blood flow is important before developing an exercise program.⁴

❖ Fetal Responses to Maternal Exercise

Some studies referenced by Artal and O'Toole have reported a 10-30 beats/per minute increase in fetal heart rate over baseline after a mother has participated in physical activity.¹³ On the other hand, bradycardia and heart rate decelerations occurred in 8.9% of those studied. In these studies, it was not reported whether the fetus had any lasting or adverse effects.¹³ Likewise, no adverse fetal developmental effects from exercise have been reported in normal and insulin-requiring gestational diabetic pregnancies.^{16,17}

Metabolic Changes

As the uterus expands, it displaces the diaphragm, which often creates discomfort and dyspnea, both at rest and during exercise.¹³ During gestation, the expanded uterus displaces the diaphragm causing an increased effort of breathing and a heightened resting oxygen requirement.¹³ It is prudent to advise a pregnant woman to stop exercising before the point of exhaustion to remove the detrimental effect of reduced uterine blood flow, increased body temperature and dehydration.^{15,18}

A pregnant woman's body compensates for the increased demand of exercise. In the middle of physical activity, plasma is funneled from the capillaries, resulting in an increased concentration of oxygen-laden red blood cells in the circulation. This also increases oxygen availability to the developing infant.¹⁸

Oxygen consumption during exercise, such as stationary cycling or swimming, is the same or greater in later trimesters as compared with postpartum.¹⁹ After the thirteenth week of pregnancy, daily energy requirements gradually increase to meet the metabolic needs of pregnancy.

Exercise helps to regulate glucose transport and intracellular metabolism, while maintaining insulin sensitivity.^{4,14} Blood glucose levels are maintained through balanced nutrient intake and exercise. Some hormones are associated with glucose homeostasis, but the bulk of work is done unconsciously through feedback systems in the body. There are several hormones involved in glucose homeostasis²⁰:

- ❖ Growth Hormone stimulates cells to enlarge and divide and facilitates protein production.
- ❖ Thyroxine (T3 and T4) from the thyroid gland, helps regulate metabolism of lipids, proteins and carbohydrates in cells as an energy source.
- ❖ Cortisol, an adrenal hormone, affects glucose metabolism. When the blood glucose drops, cortisol increases the blood glucose level by a process called gluconeogenesis. Basically, the liver makes the new glucose from non-carbohydrate sources, amino acids and glycerol from triglycerides.

- ❖ Glucagon from the pancreas, stimulates the liver to decompose stored glycogen into glucose when blood glucose levels drop. Glycogenolysis helps bring glucose levels back toward normal. Glucagon also helps with gluconeogenesis.
- ❖ Insulin made by the pancreas helps lower the blood glucose levels and affects sugar, protein and fat metabolism.
- ❖ Somatostatin, also made by the pancreas, controls the glucose metabolism by inhibiting secretions of insulin and glucagon.
- ❖ Epinephrine/Norepinephrine from the adrenal glands, helps stimulate cardiovascular, respiratory and nervous systems, and promotes processes to increase blood glucose levels when there is a demand for more energy.

The decrease in blood glucose level is dependent on the level and duration of exercise. Any weight bearing exercise may decrease insulin resistance.¹

Based on these changes, exercise should be considered a treatment option for pregnant women with diabetes.¹ However, initiation of exercise is not without risk.

For a pregnant woman with diabetes who takes insulin, metabolic changes and exercise can increase the risk of hypoglycemia, especially during long duration activity.⁶ The impairment in the mobilization of liver glycogen stores, common during pregnancy¹⁴, may further compound hypoglycemia. Insulin, meal guidelines, and snack guidelines may require adjustment to meet exercise demands and the needs of metabolic changes of pregnancy.^{4,16} Carbohydrates are an important fuel source for maintaining homeostasis during pregnancy. Once a pregnant woman with diabetes achieves a balance between snacks, insulin, and exercise, she protects herself from episodes of hypoglycemia, hypoinsulinemia, and hyperketonemia.

Musculoskeletal Changes

Some of the changes that occur during pregnancy, such as enlargement of the uterus and breasts, result in a shift in the center of gravity for a pregnant woman.¹³ These physical changes may make some activities more difficult to perform. Activities that involve significant balance or risk of trauma (cycling, running) may require adjustment or cessation to avoid injury. The following musculoskeletal changes occur during the third trimester of pregnancy and should be considered when planning a pregnancy exercise program:

- ❖ Joint laxity secondary to relaxation of ligaments¹³ (particularly in the pubic symphysis and sacroiliac joints)
- ❖ Cartilaginous softening
- ❖ Shifting of the center of gravity resulting in lumbar lordosis and potential balance problems¹³

The postural changes and the joint loosening often result in lower back pain.¹³ Women should routinely perform exercises to strengthen the back and abdominal muscles to prevent or relieve symptoms. Artal and O'Toole explain that the "Anatomical and physiological changes during pregnancy have the potential to affect the musculoskeletal system at rest and during exercise."¹³ Due to joint laxity, women should be cautious when stretching to avoid hyperextension of the joint. Non-weight-bearing exercise is of particular benefit to the pregnant woman with diabetes due to the increased use of carbohydrates by the activation of major muscles and the lower risk for impact injuries.¹⁶

Thermoregulatory Changes

❖ **Maternal Thermoregulatory Control**

A pregnant woman's core body temperature increases when exercise is intense and/or of long duration.^{13,19} It also rises faster in hot and humid environments.¹³ Pregnant women who are accustomed to exercise are better adapted to dissipating heat than women who have been sedentary. Bell et al explain that "The level of hydration also affects the increase in temperature during exercise, the increase in core temperature being greater if the exerciser is underhydrated."¹⁹ Dehydration can also adversely affect blood glucose levels and heart function. Therefore, to maintain adequate heat dissipation, women should be encouraged to maintain adequate hydration, wear appropriate clothing, including appropriate footwear, take frequent breaks and exercise during optimal environmental temperatures.

❖ **Fetal Thermoregulatory Control**

Data surrounding the issue of fetal temperature in relationship to maternal body heat caused by exercise is scarce. Artal and O'Toole give some light on the topic by explaining that "Fetal body core temperatures are about 1°C higher than maternal temperatures."¹³

Decrease in Exercise Performance During Pregnancy

Because of the physiologic changes brought about by pregnancy, many women who exercise regularly may notice a slow recession in performance beginning in early pregnancy. This decline is related to changes in aerobic capacity and changes in maternal morphology, pregnancy-related fatigue, nausea and vomiting.²¹ Most of these factors are related to cardiovascular, metabolic, musculoskeletal blood flow and heat production changes that occur during the third trimester.

**PRE-EXERCISE
EVALUATION**

The pre-exercise evaluation should include⁴:

- ❖ Assessment of glycemic control (A1c and blood glucose patterns)
- ❖ Cardiovascular exam
- ❖ An ECG is recommended for anyone over the age of 40 years with type 1 diabetes or type 2 diabetes of > 10 years in duration
- ❖ Ophthalmologic exam
- ❖ Assessment of placental health

**EXERCISE
RECOMMENDATIONS**

An individualized medical assessment must take place before an exercise plan is determined because it requires evaluation of possible risks and a patient's physical capability to be active in a variety of settings. Not-to-mention patient medical and obstetric history must be taken into consideration.¹³

The following section discusses exercise guidelines for a pregnant woman with diabetes during preconception, antepartum and postpartum.

Preconception

Exercise should be individually prescribed and monitored for a woman with preexisting diabetes who is attempting to conceive.

If a woman is just starting an exercise program, she should be provided education regarding medication changes, specifically insulin or oral hypoglycemic agents, and a review of the meal and snack plan necessary to meet exercise and blood glucose goals.

If a woman has been exercising regularly, the health care provider should complete an assessment of her knowledge about insulin and medication changes, food changes, use of snacks to meet exercise requirements and appropriate treatment of exercise-induced hypoglycemia.

If a woman utilizes exercise as part of a preconception weight loss program, as her weight loss progresses, a decrease in insulin dosage or oral hypoglycemic agent rather than an increase in calories to prevent hypoglycemia will likely be needed to maintain or achieve optimum weight.

Table 2 summarizes general preconception exercise guidelines for a woman with preexisting diabetes.

Table 2. GENERAL PRECONCEPTION EXERCISE GUIDELINES FOR A WOMAN WITH PREEEXISTING DIABETES*	
Type	<ul style="list-style-type: none"> • Suggest aerobic activities that use large muscle groups suited to the individual patient¹³ including light exercises and/or calisthenics to improve muscular strength and tone (Refer to <i>Appendix A</i>). • Avoid high intensity exercise, competitive activities or exercise in hot, humid environments¹³ if conception is suspected. • For weight loss, encourage low impact activities. Choose or modify exercise based on complications, if present.
Frequency	<ul style="list-style-type: none"> • Encourage exercise 4-6 days a week (or every day if low or moderate intensity) on at least 3 non-consecutive days for improved glycemic control.²²
Duration	<ul style="list-style-type: none"> • 20 - 60 minutes total time per workout of either continuous movement or accumulated sessions of at least 10 minutes at a time.²²
Intensity	<ul style="list-style-type: none"> • Aim for 50 - 80% of heart rate reserve. • The “talk test” and Borg’s Rating of “perceived exertion” are useful tools for monitoring and maintaining optimum exercise intensity.² For example, a woman with autonomic neuropathy may not experience increased heart rate with increased activity. Subjective signs such as the ability to talk while exercising should be used to monitor the determined level of activity for this woman.²³ • Strength and flexibility training are also an important aspect of a complete fitness program and should be incorporated into a weekly fitness program.
Resistance Training	<ul style="list-style-type: none"> • Resistance training should be encouraged in the absence of complications with a frequency of 2 - 3 days per week. Each exercise session should consist of 2 - 3 sets of 8-12 repetitions with at least 48 hours separating the exercise sessions.²²
*after medical clearance	

Exercise During Pregnancy

A pregnant woman with preexisting diabetes or one who develops GDM can exercise with appropriate education and planning.¹² It is recommended that a pregnant woman with diabetes be provided an individualized exercise plan.^{13,19} Individualizing an exercise program includes:

- ❖ An assessment of her current health and physical fitness
- ❖ Development of a program specific to her ability and motivation
- ❖ Recommendations for fluid and food intake
- ❖ Information about activity limitations, contraindications and warning signs¹³

Most pregnant women with diabetes, whether it is type 1 diabetes, type 2 diabetes or GDM, can continue to exercise throughout pregnancy. For pregnant women with diabetes, *Appendices A and B* outline suggested strengthening exercises, appropriate modes of exercise, recommendations for exercise success, strength training recommendations and how a little change can make a big difference.

Table 3 addresses general guidelines for prenatal exercise for a woman with diabetes.

Table 3. PRENATAL EXERCISE GUIDELINES FOR A WOMAN WITH DIABETES*	
Type	<ul style="list-style-type: none"> • Davies et al suggest that “Women should choose aerobic activities that will minimize the risk of loss of balance and fetal trauma.”² Some great examples are stationary bike, easy strolling, cross-country skiing, swimming and arm mobility for an upper body workout.² Avoid high impact or excessively jarring exercises and contact sports.² • Exercise in the supine position should be avoided after the first trimester (individual differences may apply).² • Both aerobic and strength conditioning exercises are promoted in all pregnant women who are without complications as this is part of a balanced and healthy lifestyle.² • Before becoming pregnant, if a woman exercises consistently, she can usually continue her regimen after becoming pregnant, keeping in mind the necessary precaution and safety considerations mentioned throughout this chapter.²
Frequency	<ul style="list-style-type: none"> • ACOG recommends that pregnant women participate in 30 minutes or more of modest physical activity most days if not every day.²⁴ • For previously sedentary women, start with at least 15 minutes of continuous exercise 3 times per week. Slowly increase each workout from 15 minutes to 30 minutes 4 times a week.² A good goal is to reach a total of 150 minutes per week.
Duration	<ul style="list-style-type: none"> • Do not exercise to exhaustion.¹⁸ A single exercise session should incorporate both a warm-up and a cool-down lasting about 5-10 minutes each.^{4,22}
Intensity	<ul style="list-style-type: none"> • Moderate activity is appropriate. Additionally, women can maintain their regular level of aerobic activity, provided there are no contraindications or risk of pregnancy complications and that they consult regularly with their healthcare provider.²⁵
*In type 1 diabetes, exercise does not always improve glycemic control. ⁴	

Exercise can play a significant role in improving glycemic control during pregnancy, particularly for women with GDM and is generally recommended.^{3,16} At the end of this section we will summarize precautions and contraindications. Based upon the physiologic changes previously outlined, the exercise intensity may have to be decreased during pregnancy. Exercise for a woman with GDM is an extremely useful intervention for maintaining normoglycemia.^{3,16}

Exercise also helps to control weight gain in a woman with GDM.¹ Moderate exercise, such as walking before or after a meal, or swimming before a meal, can effectively lower blood glucose levels. Exercise can be used during times of the day when blood glucose levels are problematic. Moderate exercise for twenty to thirty minutes is often of sufficient duration to impact blood glucose values. A woman who requires insulin should follow the guidelines in Table 4.

Table 4 describes blood glucose values and carbohydrate needs for physical activity during pregnancy.

Table 4. BLOOD GLUCOSE VALUES AND CARBOHYDRATE NEEDS FOR PHYSICAL ACTIVITY DURING PREGNANCY FOR WOMEN WITH PREEXISTING DIABETES	
Blood Glucose Level	RECOMMENDED TREATMENT
> 250 mg/dL	Check urine ketones. If positive do not exercise until ketones are Negative. ⁷ Call doctor for advice.
100 - 250 mg/dL	No extra food; blood glucose above 130 mg/dL at 1 hour after a meal is outside CDAPP Sweet Success goals. ⁷ Call doctor for advice.
<100 mg/dL	Eat a pre-exercise carbohydrate snack. ⁷
< 70 mg/dL	Treat for hypoglycemia; start exercise after blood glucose is at target level. ²⁶

Exercise Considerations

Warm-up and cool-down exercises are especially important in pregnancy. A warm up period of 5 - 10 minutes should include low intensity calisthenics or a planned aerobic activity at a lower intensity. This increases circulation and raises body temperature, preparing the skeletal muscles, heart, and lungs for a progressive increase in exercise intensity. A 10-minute cool-down allows the breathing and heart rate to return slowly to pre-exercise levels. Stretching for at least ten minutes is recommended and can follow the warm-up or cool-down session.²²

The use of insulin or oral hypoglycemic agents (OHA) to control blood glucose levels requires additional planning for exercise. Women who use these medications are more vulnerable to exercise-related hypoglycemia, primarily because of the uncertain effects of previously injected insulin or already ingested OHA.^{3,27} Education aimed at helping the woman make adjustments to the insulin or OHA dose and meal plan, based on blood glucose testing, can help prevent exercise-induced hypoglycemia and provide information on how exercise affects blood glucose levels.²⁷

CDAPP Sweet Success goals for blood glucose control during pregnancy are^{28,29}:

- fasting 60-89 mg/dL
- one hour postprandial 100-129 mg/dL (plasma values)

If a woman is having blood glucose values outside these targeted goals before, during, or after exercise, the treatment team should be consulted to help make appropriate adjustments. Self-monitoring of blood glucose should be incorporated into the exercise program to provide feedback on the necessity of adjusting diet or insulin dosage.^{27,30}

The following information is provided to assist the treatment team when making adjustment recommendations.

❖ **When to Exercise/When to Avoid Exercise**

A woman with GDM on insulin therapy should be encouraged to exercise after eating a meal. This may help to blunt the postprandial glucose response provided blood glucose values are within target range.³¹

Activities that require much balance and have the potential for falling or activities that have the potential for abdominal trauma should be suspended during pregnancy. The American College of Obstetricians and Gynecologists (ACOG) gives a few examples of these such as horseback riding, gymnastics and racquet sports. Additionally, contact sports like basketball, ice hockey or soccer should also be suspended. The mother and her unborn child are at a heightened risk for trauma during contact sports and therefore they should be avoided. Scuba diving should be discontinued during pregnancy.²⁴ Refrain from exercising in extreme weather conditions like high humidity, heat or very cold temperatures. Likewise, refrain from exercise when insulin action peaks.⁴

❖ **Special Considerations for Women Using Insulin**

- Some considerations are especially warranted for a pregnant woman on insulin who exercises.
- The abdomen is the preferred insulin injection site. If another site is used, avoid using a leg or arm if it will be exercised heavily within 60-90 minutes of the injection.
- Keep a fast-acting carbohydrate source close at hand.
- Drink water before, during and after exercise to remain hydrated.

- ❖ **Balancing Snacks, Insulin, and/or Oral Hypoglycemic Agents**
Snacks are often needed during exercise to prevent exercise-induced hypoglycemia. In pregnancy complicated by diabetes, the blood glucose goals are closely controlled and snacks may be needed even for light to moderate activity. Snacks provide additional kilocalories and carbohydrates to be utilized during the exercise period.

Table 4 on page 9 indicates when carbohydrates are needed based on blood glucose values. It is important for the health care team to know if blood glucose values rise greater than 250 mg/dL or if ketones are present in the urine. The presence of ketones in the urine may indicate that the woman is insulin deficient and exercise will not improve blood glucose control under these circumstances. In this case, treatment should be aimed at improving glycemic control before implementing an exercise program. However, physical activity does not need to be suspended solely due to the presence of hyperglycemia as long as blood and/or urine ketones test negative and the individual is in good health.³²

Women utilizing an insulin pump have more options in relation to exercise. Rather than adding carbohydrate to feed the insulin on board, a woman with an insulin pump may decrease her pre-meal bolus if exercising within 60 to 90 minutes of a meal. She also has the option of reducing her basal rate. As a starting point, a reduction of 20% of the basal rate is recommended with light exercise. Light exercise includes walking or leisurely bicycling for 30 minutes. With moderate exercise, she may need a reduction from 50% or more of the basal rate. Moderate exercise includes playing tennis, jogging or cycling for 30 minutes. It is recommended that a minimal basal rate be continued. Suspending pump basal infusion longer than 1 hour is not recommended due to the accelerated ketone production of pregnancy. Women utilizing an insulin pump should adjust their basal rate according to their personal experience with exercise and insulin requirements.

The duration of the pregnant woman's exercise will dictate the amount of carbohydrate required. Snacking in the following way before and during prolonged exercise can prevent hypoglycemia.

- Make sure to have a meal 1-3 hours prior to any physical activity.⁷
- In women taking insulin, extra carbohydrate should be ingested if pre-exercise blood glucose levels are < 100 mg/dL.³²
- If an exercise routine is lengthy (> 60 minutes) and strenuous, ingest a supplemental carbohydrate (about 20-25 g) every 30 minutes.⁷
- After prolonged exercise (> 60 minutes) decrease in blood glucose levels may occur several hours after exercise or may remain lowered for 12-18 hours. This may require a decrease in intermediate-acting insulin or additional snacks several hours later.⁷

Precautions and Safety Considerations

Women should be evaluated by their healthcare provider to determine whether an exercise program is appropriate. The risks may outweigh the benefits of exercise for women with chronic, severe medical conditions or history of poor pregnancy outcomes.^{13,24} Many well controlled conditions are not obstacles to regular physical activity.

A pregnant woman should be advised to stop exercising immediately and call her doctor if she experiences cramping, contracting or uterine bleeding, alterations in consciousness, severe cardiorespiratory symptoms or decreased fetal movement.^{2,13,24}

A pregnant woman should never participate in physical activity following diagnosis of significant pregnancy complications (e.g. preterm labor, pregnancy-induced hypertension, second or third trimester bleeding).^{2,13,24,33} As with all exercise programs, careful supervision by the healthcare provider is necessary to minimize risks.

Postpartum Exercise

An exercise program for postpartum and beyond is helpful for blood glucose control and is appropriate for healthy weight maintenance. The health care team should work with the woman to develop an exercise plan based on her medical condition and take the following factors into account:

- ❖ A woman should resume exercise at low intensity and gradually increase to preconception levels based on her physical capacity. After delivery it often takes 4-6 weeks for morphologic and physiologic changes that come from gestation to stabilize.^{13,34}
- ❖ The exercise program should be modified to prevent excessive fatigue, taking into account the increased demands of breastfeeding and motherhood.² In addition, it should work with other aspects of her self-management plan to promote optimal blood glucose control.
- ❖ A woman on insulin needs to be aware of decreased insulin needs postpartum and during breastfeeding to prevent hypoglycemia.³⁵
- ❖ A woman using oral hypoglycemic agents may need decreased medication to prevent exercise-induced hypoglycemia.
- ❖ Exercise in an adequately nourished woman, should not negatively impact breastfeeding or a woman's milk supply.^{1,2}


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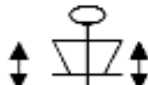
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Appendix A


Suggested Strengthening Exercises for a Pregnant Woman with Diabetes

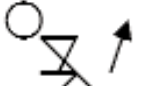
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Overhead Press - Both arms push up to meet overhead from about shoulder level. Return to start. Repeat.
- 


Shoulder Raise - With arms down by your side, raise to about shoulder level then return to your sides and repeat.
- 


Upright Row - Hold weights* together, arms extended down. Lift weights up to just under your chin with elbows higher than hands. Lower and repeat.
- 


Chest Crossover - Hold arms at shoulder level with elbows slightly bent. Bring arms together in front of your body, crossing forearms one over the other. Return to start and repeat.
- 


Low Row - Begin with arms close to your sides, elbows bent at 90. Pull both arms back simultaneously until hands are at your sides then push arms out in front. Repeat.
- 


One Arm Bendover Row - Lean forward supporting upper body on your leg (or a chair back or table). With one arm pull weight* up and back, leading with your elbow. Lower weight and repeat.
- 

Biceps Curl - With arms extended, palms up, bring weights up to your shoulders, keeping elbows close to your sides. Lower and repeat.
- 

Triceps - Hold one weight in both hands overhead. Lower weight behind your head and slowly raise up extending overhead. Keep elbows close to your head. Repeat.
- 

Seated Leg Lift - Seated with feet flat on floor, extend (straighten) one leg at a time with toes pointed up. Lower and repeat with other leg.
- 

Standing Leg Curl- Stand facing a wall (or chair back for support). Lift one foot up to buttocks, bending at the knee. Lower and repeat with other leg.
- 

Wall Sit - With back to a wall, assume a seated position, feet out and apart, knees bent. Hold 3 seconds. Stand then repeat.
- 

Standing Squat - With feet flat on floor, shoulder width apart, hold head up, back erect. Slowly lower hips until thighs are parallel to floor. Return to standing position. Repeat.

Adapted from A Turner, MS. Handout for clients, 2000. Used with permission.

Appendix B**Appropriate Modes of Exercise for Pregnancy Complicated by Diabetes:**

- Walking
- Water aerobics
- Low impact aerobics
- Bicycling (only in early pregnancy)
- Dancing
- Light weight training
- Step aerobics (until uterus blocks vision of step)
- Treadmill walking
- Swimming
- Stepping Machine (including elliptical)
- Stationary bicycling
- Yoga

Recommendations for Exercise Success:

- Exercise with a partner whenever possible
- Know signs and symptoms of hypoglycemia
- Carry source of carbohydrate
- Wear supportive clothing
- Carefully select footwear for optimal fit and comfort
- Avoid exercise in hot or humid weather
- Drink water liberally
- Set realistic goals
- Schedule exercise (specific days and time)
- Choose convenient location
- Go slow in the beginning; exercising too hard or too fast may result in injury
- Choose activities that are fun and enjoyable
- Vary exercise routine

Strength Training Recommendations:

- Perform all exercises with good posture and proper technique (if possible, have woman review proper technique with a skilled professional)
- Start with light weights
- Use slow and controlled movements: 2 seconds lifting and 2-4 seconds lowering
- Never hold breath
- Breathe out during each lifting movement and breathe in during each lowering movement
- Add more repetitions as each exercise becomes easier
- Increase weight only when an exercise becomes very easy
- Perform strength exercises every other day
- Stop at any signs of discomfort

*Weight size should be governed by the mother's level of fitness. Beginners should use 1-3 lb weights. Those who have some level of fitness should use 3.5-5 lb. weights.

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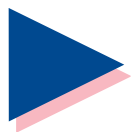
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CDAPP Sweet Success Guidelines for Care

Chapter 7

Medical Nutrition Therapy



*Sweet
Success*

California Diabetes and Pregnancy Program

California Diabetes and Pregnancy Program Sweet Success Guidelines for Care

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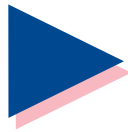
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7 Medical Nutrition Therapy

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7 Medical Nutrition Therapy

INTRODUCTION

Research has shown that Medical Nutrition Therapy (MNT) by registered dietitians is the primary intervention in the management of Gestational Diabetes Mellitus (GDM). It leads to improved perinatal outcomes¹, and is a key component of glycemic control.² The focus of nutrition care is similar for pregnant women with diabetes as for all pregnant women. The goal for women with diabetes is also to meet all of the nutrition needs of the fetus and mother while additionally maintaining maternal normoglycemia.³ Rationale for the meal plan includes achieving a preconception weight goal and optimal nutrient intake, maintaining normoglycemia and optimal nutrient intake throughout pregnancy, and attaining appropriate weight gain in each trimester.

A pregnant woman with type 1 diabetes, type 2 diabetes, or GDM is at high risk for adverse pregnancy outcomes.⁴⁻⁶ A Registered Dietitian (RD) who specializes in perinatal and diabetes care is the indicated provider for the initial nutrition assessment and for the development of the medical nutrition therapy (MNT) plan. This plan should address the goals of normoglycemia and the nutrition needs of women before, during, and after pregnancy. It is recommended that a RD assess the woman's dietary needs, individualize the meal plan, and closely monitor food intake, exercise, and blood glucose levels to meet glycemic and nutrient intake goals⁷ (see Table 1). An individualized MNT plan needs to be developed and implemented by a RD to thoroughly address the risks and/or complications that can result from diabetes. These maternal risks include hypertension, nephropathy, retinopathy and gastroparesis.⁸

MEDICAL NUTRITION THERAPY FOR PREGNANCY AFFECTED BY DIABETES

MNT includes⁹:

- ❖ The use of a patient nutrition assessment to determine treatment strategies
- ❖ A nutrition therapy plan that is initiated to treat an illness, injury or condition
- ❖ Evaluation of patient outcomes to determine the effectiveness of the treatment

The RD is also responsible for the following:

- ❖ Making recommendations on kilocalorie needs, distribution of carbohydrates, and meeting nutrient requirements before, during, and after pregnancy
- ❖ Integrating the MNT plan with overall medical management and education goals regarding euglycemia, weight gain, medications, exercise, and breastfeeding
- ❖ Advising team members of physical and/or psychosocial issues impacting nutrition practices and the necessary changes in the meal pattern and lifestyle to achieve the goals of the care plan

The basic objectives of MNT for diabetes in pregnancy are:

- ❖ Set appropriate weight goals
- ❖ Determine caloric needs
- ❖ Develop an individualized, nutritionally balanced meal plan
- ❖ Recommend vitamin/mineral supplementation as needed
- ❖ Provide education concerning nutrition-related issues
- ❖ Counsel on the importance of normoglycemia before, during, and after pregnancy
- ❖ Evaluate adherence to the meal plan
- ❖ Provide evidence-based recommendations
- ❖ Promote patient empowerment

Nutrition Assessment

To develop an individualized MNT plan, a nutrition assessment must be completed by the RD.⁹ A nutrition assessment includes, but is not limited to, the components found in Table 1.

The following high-risk conditions in women with diabetes may require more frequent and intensive nutrition intervention and counseling by the RD⁸:

- ❖ Poor blood glucose control
- ❖ History of frequent problems with diabetic ketoacidosis (DKA)
- ❖ History of frequent episodes of hypoglycemia
- ❖ Initiation of intensive diabetes management, either through multiple daily injections or insulin pump therapy
- ❖ Underweight, overweight, or obese
- ❖ Prediabetes
- ❖ Eating disorders
- ❖ Hypertension
- ❖ Renal dysfunction
- ❖ Celiac disease
- ❖ Significant weight increase with improving blood glucose control
- ❖ Dyslipidemia
- ❖ Inappropriate weight gain or loss

- ❖ Other conditions: infertility, hyperemesis, thyroid dysfunction, polycystic ovarian syndrome (PCOS), impaired vision, blindness, mental retardation
- ❖ Other nutrition risks: pica, multiple gestation, bariatric surgery, adolescence, low literacy, low income, psychosocial issues impacting diet, dietary beliefs that are either religious, cultural or philosophical

Table 1. COMPONENTS OF A NUTRITION ASSESSMENT⁹		
Clinical Data	Psychosocial History	Dietary History
Determine: - height/weight measurement - weight history/Body Mass Index/Ideal body weight - diabetes history, including: history of GDM duration of diabetes hypoglycemia diabetes complications family history - medication regimen for diabetes - other prescription or over the counter medications in use - previous obstetrical history - medical test data pertinent to diabetes and pregnancy (hemoglobin A1c, self-monitoring blood glucose, creatinine clearance, thyroid function) - hemoglobin/hematocrit/MCV - blood pressure	Assess: - learning needs, abilities, literacy level, education background - language and culture background - exercise pattern - living situation - financial and employment status - family support - ethnic or religious beliefs - attitudes toward health including current diabetes knowledge - daily schedule	Assess: - usual food intake and pattern of intake with emphasis on micronutrient identification - food allergies/intolerances - alcohol, tobacco, caffeine, substance use - vitamin and dietary supplement use - use of natural remedies - knowledge of nutrition and meal planning skills - previous history of following a diet and adherence - other nutrition risks (e.g. eating disorders, adolescence, low literacy, low income, psychosocial issues)

Individualized Medical Nutrition Therapy Plan

As a primary member of the health care team, the woman will take part in the development of goals that are individualized to accommodate her unique lifestyle.¹⁰ On completion of the initial history and assessment, the individualized MNT plan should be developed and

implemented based on the woman's needs and abilities. The RD must be willing to negotiate with the woman to develop a plan that meets dietary goals and one that the woman will be able to follow.¹⁰

The results of the nutrition assessment and development of the MNT plan should be communicated to other team members and documented in the woman's medical record. Communicating the MNT plan to others will help ensure that the woman receives consistent messages, as well as support and reinforcement from the entire team. The MNT plan and carbohydrate distribution will need to be regularly reassessed.

PRECONCEPTION AND INTERCONCEPTION NUTRITIONAL CARE

Women who experience ongoing health issues, such as problems with weight or diabetes mellitus should be consistently receiving the proper care during the preconception and interconception periods, also known as internatal care. Dr. Michael Lu, Associate Administrator of Maternal and Child Health Bureau of the Health Resources and Services Administration, explains that the foundation of internatal care is comprised of “risk assessment, health promotion, and clinical and psychosocial interventions.”¹¹ Nutritional status can be addressed in each of these four basic components of preconception and interconception care. For example, in the risk assessment category BMI and dietary intake can be taken into consideration. To promote health, folate supplementation can be encouraged. A calorie-restricted diet or starting/altering an exercise program may be needed as a clinical intervention. Finally, behavior modification strategies can be taken into account if psychosocial interventions are needed.^{11,12}

Refer to *Chapter 2: Preconception and Interconception Care for Preexisting Diabetes* for a description of the CDAPP Sweet Success model of diabetes preconception and interconception care.

Normoglycemia for Preconception

The glycemic goal for women with preexisting diabetes, and pre-diabetes, both preconceptionally and after conception, is normoglycemia.¹³ Pre-diabetes is a condition where blood glucose levels are higher than normal, but not high enough for a diagnosis of diabetes. The woman with preexisting diabetes, and pre-diabetes should have HbA1c within target range before attempting to become pregnant. Keep in mind that the HbA1c is an average blood glucose assessment and that a target HbA1c level can be achieved with suboptimal blood glucose swings. Frequent glucose monitoring, in conjunction with HbA1c level tests, is recommended to assess stability of blood glucose levels. The California Diabetes and Pregnancy Program follows the recommendations of the American Diabetes Association and recommends the plasma blood glucose values for the preconception and pregnancy period as depicted in *Chapter 2: Preconception and Interconception Care for Preexisting Diabetes* and *Chapter 3: Medical Management and Education for Preexisting Diabetes During Pregnancy*.

For a woman with preexisting diabetes, normalization and maintenance of blood glucose levels requires a balance between medication, distribution of carbohydrate, kilocalories, and activity; as well as identification of individual glycemic response to specific foods. Self-monitoring of blood glucose is essential to evaluate how well goals are being met.⁸

Preconception Weight Goals

Weight goals are dependent on a number of factors. Historically, a woman with preexisting diabetes has been encouraged to achieve an ideal body weight (IBW) before conception. Being obese or underweight may adversely affect fertility and pregnancy outcome.¹⁴ Therefore, for an infertile woman who is not at her IBW, a plan for losing or gaining weight is necessary prior to conception.

Preconception overweight is an increasingly more common high risk obstetric complication and special care needs to be directed to these women. Galtier-Dereure et al have found that “Preconception counseling, careful prenatal management, tight monitoring of weight gain, and long-term follow-up could minimize the social and economic consequences of pregnancies in overweight women.”¹⁵

Maternal overweight and obesity increase the risk of birth defects, pregnancy complications, and adverse pregnancy outcomes.¹⁶ MacNeill et al note that “Women whose prepregnancy weight at the start of the subsequent pregnancy was ≥ 190 lbs were 70% more likely to have a recurrence of GDM, adjusting for infant birth weight in the index pregnancy.”¹⁷ If a woman’s BMI escalates prepregnancy regardless if she has been categorized as overweight or not, she still faces a higher risk for GDM and perinatal complications.¹⁸ Therefore, preconception counseling for women with preexisting diabetes and prior GDM should address the issue of weight management.

Achieving an ideal body weight may be unrealistic for many women. Achieving a reasonable body weight may be a more appropriate goal.¹⁰ A reasonable body weight is defined as a weight the woman can reach and maintain over an extended period of time. Weight goals should be developed in conjunction with the woman to increase the opportunity for successful achievement of the weight goal. Particularly in a non-pregnant woman with type 2 diabetes, a weight loss of 5% to 10% of current body weight could significantly improve glycemic control.¹⁹

Determining Preconception Energy Needs

For a woman with preexisting diabetes, energy needs have to be calculated to meet her preconception weight goal. Kilocalorie levels may be calculated utilizing the method described below for the estimated energy requirement (EER). Reported dietary intake is used

along with clinical judgment to help assess the appropriateness of the calculated calorie level, and to provide a realistic calorie level for the woman. Weight loss, weight gain, weight maintenance, energy expenditure from activity, and other factors also influence energy needs. Maternal undernutrition during conception and early pregnancy can result in a poor pregnancy outcome and can affect the lifelong health of the child.²⁰ Maintaining an adequate diet well in advance of pregnancy will help to avoid a disruption of blood glucose control as a result of large changes in dietary composition in early pregnancy.

The Physical Activity Coefficients data as well as the Nonpregnant Estimated Energy Requirement data found below is used with permission from The National Academies Press (Institute of Medicine and the National Research Council).²¹

Calculating Nonpregnant Estimated Energy Requirement (EER)²¹

- ❖ For women 14-18 years of age:

$$\text{EER} = 135.3 - (30.8 \times \text{age in years}) + \text{Physical Activity (see below)} \times [(10.0 \times \text{weight in kilograms}) + (934 \times \text{height in meters})] + 25$$
- ❖ For women greater than or equal to 19 years of age:

$$\text{EER} = 354 - (6.91 \times \text{age in years}) + \text{Physical Activity (see below)} \times [(9.36 \times \text{weight in kilograms}) + (726 \times \text{height in meters})]$$

Determining Physical Activity Coefficients²¹

- ❖ Sedentary (e.g. typical daily living activities):
 - 14-18 years = 1.0
 - ≥ 19 years = 1.0
- ❖ Low Active (e.g. typical daily living activities in addition to 30 - 60 minutes of daily moderate activity):
 - 14-18 years = 1.16
 - ≥ 19 years = 1.12
- ❖ Active (e.g. typical daily living activities in addition to at least 60 minutes of daily moderate activity):
 - 14-18 years = 1.31
 - ≥ 19 years = 1.27
- ❖ Very Active (e.g. typical daily living activities in addition to at least 60 minutes of daily moderate activity plus an additional 60 minutes of vigorous activity or 120 minutes of moderate activity):
 - 14-18 years = 1.56
 - ≥ 19 years = 1.45

For example, a 26 year old, nonpregnant, moderately active woman weighing 54 kilograms and standing 1.7 meters in height, the calculation of EER would be as follows:

- ❖
$$\text{EER} = 354 - (6.91 \times 26) + 1.12 \times [(9.36 \times 54) + (726 \times 1.7)]$$
 - $354 - 179.66 + 1.12 \times 1,739.64$
 - $354 - 179.66 + 1,948.4$
 - $= 2,122.74$ kcal per day

PREGNANCY CARE**Energy Needs During Pregnancy**

Energy needs for a woman with preexisting diabetes will increase during pregnancy. However, during the first trimester the woman's energy and nutrient needs remain the same as during the preconception period, unless there are complications of vomiting or hypoglycemia. Major changes in diet composition may disturb glycemic control and are not recommended in the first trimester. In the second and third trimesters, daily energy requirements gradually increase. See Table 2 to calculate energy needs in pregnancy.²¹ Data from Table 2 is used with permission from The National Academies Press (Institute of Medicine and the National Research Council).²¹

Table 2. ENERGY NEEDS FOR PREGNANCY BASED ON GESTATIONAL AGE

The Institute of Medicine formulas for Estimating the Energy Requirements (EER) for pregnant women are as follows:

- 1st trimester EER = Nonpregnant EER + 0 kcal
- 2nd trimester EER = Nonpregnant EER + 340 kcal
- 3rd trimester EER = Nonpregnant EER + 452 kcal

*See previous section to determine nonpregnant EER

Kilocalorie needs for a pregnant woman with diabetes vary depending on her BMI, activity level, whether the pregnancy has single or multiple fetuses, pregravid weight and other factors. The goal is to meet nutrition and energy requirements for normal fetal growth with appropriate maternal weight gain.²¹ Energy needs may require adjustment during pregnancy based on blood glucose values, ketone levels and weight gain parameters.²²

Energy Recommendations for Multifetal Pregnancy

The increased caloric needs for a multifetal pregnancy would average about 150 kilocalories per day over the needs of a singleton pregnancy.²³ Tracking prenatal weight gain is the recommended method of determining if caloric intake is adequate. Proposed weight gain recommendations are found in Table 5. Consistent weight gain with 1.5 lbs per week after the first trimester appears to reduce the risk of preterm and low birth weight deliveries.²³

Body Mass Index

Body Mass Index (BMI) is used to determine the woman’s preconception weight category. BMI is calculated based on pregravid weight using the equation in Table 3.

Table 3. CALCULATING BODY MASS INDEX *	
<p>To calculate BMI using U.S. imperial units: $\text{BMI} = 703 \times \frac{\text{Weight (lbs)}}{\text{Height (in)}^2}$</p> <p>Example: Woman is 5'6" and 155 lbs</p> $\text{BMI} = 703 \times \frac{155}{(66)^2}$ $\text{BMI} = 703 \times \frac{155}{4356}$ $\text{BMI} = 703 \times .036$ $\text{BMI} = 25$	<p>To calculate BMI using metric units: $\text{BMI} = \frac{\text{Weight (Kg)}}{\text{Height (meters)}^2}$</p> <p>Example: Woman is 1.68 m and 70.5 Kg</p> $\text{BMI} = \frac{70.5 \text{ Kg}}{(1.68 \text{ m})^2}$ $\text{BMI} = \frac{70.5 \text{ Kg}}{2.82 \text{ m}}$ $\text{BMI} = 25$
<p>* If the woman enters into the program during pregnancy, special efforts need to be made to determine her actual or most accurate pregravid weight. See BMI calculator link: ✓ http://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/english_bmi_calculator/bmi_calculator.html</p>	

BMI Cut-Offs

The WHO Expert Consultation identifies BMI cut-off points as clinically relevant to “...identify high-risk individuals for screening; identify individuals for absolute risk assessment; determine the type and intensity of treatment; monitor individuals for effects of treatment over time; determine institutional policies on individuals...”²⁴

Data from Table 4 below is used with permission from The National Academies Press (Institute of Medicine and the National Research Council).²¹

Table 4. IOM PREPREGNANT BMI CATEGORIES AND CUT-OFFS WITH RECOMMENDED WEIGHT GAIN²¹			
Weight Category	BMI	Recommended Total Weight Gain Ranges	Mean Weight Gain (lb/wk) 2nd & 3rd Trimester
Underweight	< 18.5 kg/m ²	28 - 40 lbs	1 (1 - 1.3) lbs
Normal	18.5 - 24.9 kg/m ²	25 - 35 lbs	1 (0.8 – 1) lbs
Overweight	25.0 - 29.9 kg/m ²	15 - 25 lbs	0.6 (0.5-0.7) lbs
Obese	≥ 30.0 kg/m ²	11 - 20 lbs	0.5 (0.4-0.6) lbs

There are no different IOM BMI cut-offs for women with diabetes compared to the nondiabetic population. Health care providers are encouraged to give women individualized recommendations on their weight gain in pregnancy and reduction of their body fat composition, if appropriate. In evaluating the woman's weight gain during pregnancy both total and rate of weight gain must be considered.

Determining Appropriate Weight Gain Based on Prepregnancy BMI Categories

There are many publications addressing maternal and fetal complications in women who exceeded the 1990 IOM weight gain recommendations. These include a higher risk of primary cesarean section, preterm delivery, large for gestational age (LGA) infant and more need for medical therapy to control blood glucose levels.^{25,26} Lower amounts of gestational weight gain may be more appropriate for women with insulin resistance²⁷, especially if they are provided MNT which focuses on optimal nutrient intake and minimal use of discretionary calories.

The IOM does not have specific weight gain recommendations for pregnant women with diabetes. However, until further research is available, weight gain recommendations for women with diabetes in each BMI category should be in accordance with the 2009 IOM guidelines (see Table 4). Women whose weights are at the higher end of the 2009 overweight BMI category are encouraged to gain toward the lower end of that recommended weight gain range.

A position statement given by the American Diabetes Association in 2007 noted that "moderate caloric restriction (reduction of 30% of estimated energy needs) in obese women with GDM may improve glycemic control without ketonemia and reduce weight gain."²⁸ Sustained weight loss is not recommended during pregnancy. If weight loss is sustained, carefully evaluate food records for adequacy of the diet and monitor urine ketones. Restricting usual caloric intake by 30-33% in obese pregnant women has been demonstrated to prevent macrosomia.^{29,30}

At the other end of the spectrum, women in the 1990 BMI underweight category of <19.8 who gained less than the IOM recommendations were at higher risk for a small for gestational age (SGA) infant.^{25,31,32} It is very important for pregravid underweight women to gain 28-40 lbs to prevent growth restriction of the infant.

As more data about population-specific BMI cut-offs and risk factors become available, population-specific BMI cut-off points may need to be reconsidered for determining a weight category. The WHO suggests lower BMI cut-off points be added as points of public health action for Asians.²⁴ Women of Asian American and Pacific Islander descent have been identified as particularly at risk for GDM.³³ Asian American

ethnicity is recognized by the American Diabetes Association³⁴ and CDAPP Sweet Success as a risk factor for GDM. It may be prudent in developing individualized weight gain recommendations with a woman of Asian background to suggest that this woman gain at the lower end of the weight gain recommendation for their weight category.

In a prospective study of over 1000 mother-child pairs utilizing the 1990 IOM Guidelines, researchers found that mothers with excessive gestational weight gain, independent of maternal BMI and maternal glucose tolerance, had children with more adiposity at 3 years of age. They concluded that “efforts to moderate weight gain during pregnancy may help to stem the rising tide of childhood obesity.”³⁵

With the epidemic of obesity in this country, the risk of retaining extra pounds gained during pregnancy, and with increasing insulin resistance associated with gaining extra pounds, it seems prudent to avoid any extra weight gain in women with diabetes. CDAPP Sweet Success programs encourage regular physical activity which is associated with reduced risk for excessive gestational weight gain.

Monitoring Weight Gain

Use the appropriate weight gain grid to monitor weight gain (refer to *Appendix A*). Follow the pattern of weight gain every two to four weeks and make changes in the exercise and MNT plan accordingly. If weight gain is inappropriate, consider causative factors such as lifestyle and possibly psychosocial and/or medical issues. Discuss these factors with the other team members and adjust the diet, exercise or medication plan as necessary.

Excess Weight Gain

Excess weight gain is defined as a gain of 6.5 pounds (3 kilograms) or more per month for all women who are not underweight at the time of conception. In a normal prepregnancy weight woman with excessive weight gain during pregnancy, a slower rate of weight gain may be recommended. The rate of weight gain may slow down when the kilocalorie level is adjusted to meet actual needs. Factors that may cause excess weight gain are high kilocalorie intake relative to actual needs, decreased physical activity, or fluid retention. The meal plan should be carefully evaluated for all nutrients as well as kilocalories.^{22,36}

Rapid weight gain in the second and third trimesters, accompanied by edema, may indicate the onset of pregnancy-induced hypertension or preeclampsia. In some cases, a woman may experience polyhydramnios (excess amniotic fluid production). Either of these may result in an increase in weight unrelated to an excess intake of kilocalories. Blood pressure evaluations and checking a urine dipstick for the presence of protein can be used to help identify the need for special tests and medical intervention.

Inadequate Weight Gain

Slower weight gain may occur due to improved diet as a result of nutrition counseling. Inadequate weight gain is defined as a gain of less than 0.5 pounds (0.23 kilograms) per week or less than 2 pounds (0.9 kilograms) per month during the second and third trimester. Slower than expected weight gain may be adequate if the woman is in the obese category at the time of conception or has already gained excess weight.²²

Weight loss can occur for a number of reasons, including the woman's fear of increasing blood glucose levels by eating, psychosocial issues influencing the ability to eat, or lack of access to an adequate food supply. A review of food and blood glucose records can often provide clues to the cause of weight loss or inadequate gain.

Initial weight loss may represent a diuresis. This fluid loss is often seen in a woman with GDM and could be due to a shifting of the balance of carbohydrates and protein in the meal plan or to the elimination of extra calories following CDAPP Sweet Success nutrition counseling.

To assess the effectiveness of MNT, monitor weight gain carefully for the first few weeks after MNT has begun. Weight should begin to increase once the fluid shifts have subsided within 1-2 weeks of MNT. By the second follow-up visit, appropriate weight gain or weight maintenance should be established. If weight loss continues or urine ketones are persistently present, review the food diary, and consider increasing kilocalorie and/or carbohydrate intake. If the increased kilocalorie and carbohydrate intake results in hyperglycemia, initiation of medication management may be necessary.

Multiple Gestation Weight Gain

Optimal maternal weight gain for twin pregnancies is higher than that for singletons.²¹ BMI-specific weight gain recommendations have been proposed by the Institute of Medicine²¹ and Luke et al.³⁷ The Institute of Medicine notes insufficient information was available to make a weight gain recommendation for underweight (BMI <18.5).²¹ In a large, retrospective analysis, women who gained 45-65 pounds had improved birthweights. Research regarding outcomes for twin pregnancies demonstrates that women who have met recommended weight gain goals have optimal fetal growth and birth weights.³⁷ In addition, the rate of weight gain is important: appropriate weight gain prior to 28 weeks of pregnancy strongly contributes to rates of fetal growth.³⁷

Few studies are available for maternal weight gain during triplet pregnancies. In one study of 194 triplet pregnancies, maternal weight gains of <36 pounds by 24 weeks gestation resulted in lower birth weights for women with BMI <19.8 and women with BMI 19.8 - 26.³⁸

Table 5 provides a retrospective view of ranges of weight gain among women of differing prepregnancy weight categories who had term twins of normal birth weight.²¹ Data from Table 5 below is used with permission from The National Academies Press (Institute of Medicine and the National Research Council).²¹

Table 5. WEIGHT GAIN DURING TWIN PREGNANCY*²¹		
Women’s Weight Category	2009 Institute of Medicine	
	Pregravid BMI:	Weight Gain:
Underweight	No data reported	
Normal weight	18.5 - 24.9	37 - 54 lbs
Overweight	25 - 29.9	31 - 50 lbs
Obese	≥ 30	25 - 42 lbs
*37-42 weeks with average birth weight > 2,500 g		

**NUTRITION NEEDS
FOR PRECONCEPTION
AND PREGNANCY**

Nutrition recommendations during the preconception period for women with type 1 diabetes or type 2 diabetes are based on the American Diabetes Association guidelines. Maintenance of euglycemia is important to reduce the risk of congenital anomalies. The goal is also to emphasize the importance of healthy food choices for a lifetime.

Nutrient and dietary care guidelines for preconception and pregnancy for the woman with diabetes can be found in Table 6.

Table 6. DIETARY CARE GUIDELINES FOR PRECONCEPTION AND PREGNANCY	
Kilocalories	<p>Preconception: Provide adequate kilocalories for attaining a healthy weight before pregnancy. Prior to conception provide adequate kilocalories for weight maintenance. The equation for calculating the estimated energy requirement (EER) for normal weight women is depicted on page 7.</p> <p>Pregnancy: Prepregnant BMI, maternal age, rate of weight gain, physiological growth spurt and appetite must be considered in tailoring the caloric recommendation to the individual. The Daily Food Choices for Pregnant Women³⁹ is a guide for recommended amounts of food for pregnant women and may not be appropriate for all individuals. Strong scientific evidence suggests that the energy cost of pregnancy is less than previous theoretical estimations.⁴⁰ Energy estimates must be individualized based on a nutrition assessment, physical activity and weight gain patterns in pregnancy.</p>
Protein	<p>Preconception: The Recommended Daily Allowance (RDA) is 0.8g/kg/day</p> <p>Pregnancy: Requirements do not increase until the second half of pregnancy to 1.1 g/kg (or an additional 25 g/day). The pregnancy RDA for protein is 71 g/day.⁴¹</p>
Carbohydrate	<p>Preconception: The contributions of CHO to energy intake should be individualized based on nutrition assessment, metabolic profiles, and treatment goals.</p> <p>Pregnancy: The RDA is a minimum of 175g CHO/day.⁴¹</p>
Fat	<p>Preconception and Pregnancy: Less than 7% of energy intake should be derived from saturated fats and <1% trans fats.⁴² Polyunsaturated fat intake should be ~ 10% of energy intake. The rest of fat intake should come from monounsaturated fat. Pregnant women should consume 2 - 3 servings of DHA rich foods weekly to meet the suggested intake of 200 - 300 mg/day.</p>
Nonnutritive Sweeteners	<p>Preconception and Pregnancy: Consumption of acesulfame potassium, aspartame, saccharin, sucralose, and neotame within acceptable daily intakes (ADI) is safe during pregnancy.⁴³ Stevia-derived sweeteners, including stevia glycosides and rebaudioside A (Reb A), are on the Generally Recognized as Safe (GRAS) list⁴⁴ and are therefore considered safe when used in moderate amounts during pregnancy. However, there is insufficient evidence to use stevia in its whole herb form during pregnancy, such as herbal tea, supplements, or crude extracts according to Natural Medicines Comprehensive Database.^{45,46} The Academy of Nutrition and Dietetics Evidence Analysis Library notes, "...only FDA-approved non-nutritive sweeteners should be consumed and moderation is encouraged." They go on to say, "Research in this area is extremely limited."⁴⁷</p>
Fiber	<p>Preconception and Pregnancy: Adequate Intake (AI) of total fiber for women 19- 50 years is 25 g/day.⁴¹ For pregnancy the AI is 28g/day and for lactation 29g/day. A high quantity of fiber in the diet (25g/1000Kcal) slows gastric emptying time and results in a significant reduction in postprandial serum glucose and insulin levels.⁴⁸ Fiber also is effective for relief of constipation as long as it is coupled with adequate fluid intake.</p>
Sodium	<p>Preconception and Pregnancy: AI for women under 50 years is 1.5 g/day. Sodium is not routinely restricted in pregnancy and restriction has not been proven effective in preventing or delaying preeclampsia. Tolerable Upper Intake Level (UL) is 2.3 g/day.⁴⁹</p>

Folic Acid	<p>Preconception: RDA recommendation is that all women of child bearing age should consume 400 mcg/day of synthetic folic acid from fortified foods, supplements or both, in addition to consuming folate from food in a varied diet.⁵⁰ If a woman is not consuming folic acid, supplementation should start at least one month prior to conception. Women with a history of neural tube defects should increase their daily supplement to 4 mg/day one month prior to conception and through the first three months of pregnancy.^{51,52}</p> <p>Pregnancy: RDA recommendation is that women should consume 600 mcg/day of dietary folate equivalents.⁵⁰ Most prenatal supplements have at least 600 mcg of folic acid, an amount that will assist pregnant women in reaching the RDA recommendation.</p>
Iron, Zinc, Copper	<p>Preconception: RDA for iron is 18 mg/day.</p> <p>Pregnancy: RDA for iron is 27 mg/day. A low-dose iron supplement (30mg/day) is recommended beginning at the first prenatal visit. When a low Hgb or Hct is confirmed by a repeat test, an oral dose of 60-120mg of iron/day should be prescribed.^{53,54} For women taking supplements >30 mg/day of iron, 15 mg of zinc and 2 mg of copper as supplements are recommended.⁵⁴ These amounts are found in many prenatal vitamin-mineral supplements.</p>
Calcium	<p>Preconception: RDA for ages 14 - 18 years is 1300 mg/day; ages 19 - 50 years is 1000mg/day; and greater than 50 years of age is 1200 mg/day.</p> <p>Pregnancy: UL is 3000 mg/day for ages 14 - 18 years and 2500 mg/day for ages 19 - 50 years.⁵⁵</p>
Magnesium	<p>Preconception: RDA for ages 14 - 18 years is 360 mg; ages 19 - 30 years is 310 mg; and ages 31 - 50 is 320 mg.⁵⁶</p> <p>Pregnancy: RDA for ages 14 - 18 years is 400 mg; ages 19 - 30 years is 350 mg; and ages 31 - 50 is 360 mg. UL for added Mg is 350 mg.⁵⁶</p>
Vitamin D	<p>Preconception: RDA is 600 IU (15 mcg)/day and UL is 4000 IU (100 mcg)/day.⁵⁷</p> <p>Pregnancy: Same as preconception above.</p>
Multivitamin and Mineral Supplements	<p>Pregnancy: Multivitamin/mineral supplements are recommended for women with multiple gestations, iron deficiency anemia, poor quality diets, and vegan diets. Supplements are also recommended for women who smoke or use or abuse alcohol or drugs. Avoid excessive supplementation of Vitamin A. Vegans need to supplement their diet with 600 IU Vitamin D and 2.0 mcg Vitamin B12.</p>
Herbal & Botanical Supplements	<p>Pregnancy: Pregnant women should be advised to consider herbal treatments as suspect until their safety during pregnancy can be ascertained. Limit herbal teas.⁵⁸ To keep abreast of new information consult The Academy of Nutrition and Dietetics and go to the American Pregnancy web site.⁵⁸</p>
Alcohol	<p>Preconception: Avoid if planning pregnancy. May reduce fertility.⁵⁹</p> <p>Pregnancy: No alcohol. A safe level of alcohol intake has not been established for any stage during pregnancy.</p>

Table 6. DIETARY CARE GUIDELINES FOR PRECONCEPTION AND PREGNANCY, Continued	
Caffeine	<p>Preconception: Some evidence suggests high intake (> 500mg/day) may delay conception.⁶⁰</p> <p>Pregnancy: Some adverse effects on pregnancy outcomes have been linked to high caffeine intakes. Prudent advice would be to discourage >200 mg caffeine/day (i.e. limit to two 6 ounce cups of coffee/day).⁶¹</p>
Twin Gestations	A study conducted by Goodnight and Newman found that, “micronutrient and macronutrient supplementation specific to the physiology of twin gestations, and carbohydrate-controlled diets are recommended for optimal twin growth and pregnancy outcomes.” ⁶²
<p>Acronyms:</p> <p>ADI - Acceptable Daily Intake - the maximum amount of any substance that can be safely ingested by human.</p> <p>AI - Adequate Intake - A DRI component used where there is inadequate scientific evidence to establish requirements and reference intakes for a nutrient.</p> <p>BMI- Body Mass Index</p> <p>CHO - Carbohydrate</p> <p>DHA - Docosahexaenoic Acid</p> <p>DRI - Dietary Reference Intake - Nutrient reference values set by the National Academy of Sciences</p> <p>RDA - Recommended Dietary Allowance - the RDA is one of the DRI components used for assessment of an individual and is not to be used to assess intakes of groups. Usual intake at or above this level has a low probability of inadequacy.</p> <p>UL - Tolerable Upper Intake Level</p>	

Omega-3 Fatty Acids

Omega-3 fatty acids are important in human nutrition and during the perinatal period although no recommended Dietary Allowance is presently set. Omega-3 polyunsaturated fatty acids include docosahexaenoic acid (DHA), eicosapentaenoic acid (EPA), and alpha-linolenic acid (ALA). ALA is converted into DHA and EPA in animals. Fish and seafood are the highest sources of DHA and EPA, while leafy green vegetables, walnuts, flaxseeds and their oils, as well as algae are the richest sources of ALA. The conversion of ALA to EPA and DHA is very low in humans, although it improves during pregnancy and is higher overall in women compared to men. Currently, research indicates that the actual conversion is influenced predominately by the absolute amount of ALA and Linoleic Acid (LA) which is an omega-6 fatty acid in the diet, and not by the ratio of LA to ALA.⁶³

Researchers have shown a positive association between DHA in infants and improved neural and visual development. Researchers have also demonstrated that higher intakes of ALA do not increase DHA levels in pregnant mothers or infants. However, higher intakes of DHA by the mother do positively influence the DHA levels in their infants via a transfer from placental circulation and breast milk.⁶³

The current recommendation to improve the intake of omega-3 fatty acids in the perinatal period is for women to consume up to 12 ounces per week of low-mercury and preferably fatty fish.⁶⁴

According to the Environmental Protection Agency (EPA) website, the EPA recommends the following⁶⁴:

1. Do not eat Shark, Swordfish, King Mackerel, or Tilefish because they contain high levels of mercury.
2. Eat up to 12 ounces (2 average meals) a week of a variety of fish and shellfish that are lower in mercury.
 - Five of the most commonly eaten fish that are low in mercury are shrimp, canned light tuna, salmon, pollock, and catfish.
 - Another commonly eaten fish, albacore (“white”) tuna has more mercury than canned light tuna. So, when choosing your two meals of fish and shellfish, you may eat up to 6 ounces (one average meal) of albacore tuna per week.
3. Check local advisories about the safety of fish caught by family and friends in your local lakes, rivers, and coastal areas. If no advice is available, eat up to 6 ounces (one average meal) per week of fish you catch from local waters, but don’t consume any other fish during that week.

For California, local advisories can be found at the California Office of Environmental Health Hazard Assessment (OEHHA):

- ✓ <http://www.oehha.ca.gov/fish/preg/index.html>

Fish oil supplements are not routinely recommended during pregnancy.⁶³ A food based approach is recommended to improve the omega-3 fatty acid profiles during pregnancy.

MEAL PLAN DESIGN

Meal Plan Recommendations

Throughout pregnancy, placental hormones and cytokines such as human placental lactogen, progesterone, prolactin, cortisol, and TNF- α continue to increase.⁶⁵ The increasing levels of these hormones and cytokines cause changes in metabolism and blunts the effectiveness of insulin to lower blood glucose levels.⁶⁶ Most pregnant women with preexisting diabetes or GDM are very sensitive to carbohydrates. The meal pattern of three meals and 2 to 4 snacks addresses this sensitivity.²⁸ Carbohydrates are carefully spaced among several meals and snacks.⁶⁷ This meal pattern is designed to prevent episodes of hyperglycemia and to control postprandial blood glucose values. The

amount and type of carbohydrate within a single meal can also influence postprandial blood glucose values.⁶⁸ The meal and snack pattern may be individualized based on the treatment plan.

The first meal of the day is, physiologically, the meal where women show the greatest insulin resistance. Better blood glucose management may be achieved if carbohydrates are more limited at this meal.²⁹

To manage the increased carbohydrate sensitivity seen during pregnancy and achieve euglycemia, total carbohydrate intake should be a minimum of 175 grams per day and less than 45% of energy.⁴⁷ The total daily carbohydrate levels and distribution should be individualized to tolerance and preference. If the woman must restrict her intake below this level in order to achieve glycemic control, insulin or medication therapy should be considered. It is also important to mention that careful attention should be given to the nutrient composition during pregnancy to assure that the diet does not become unbalanced as emphasis shifts from exchange food groups to counting carbohydrates.

Factors that affect individual responses to foods (week of gestation, amount of insulin or glyburide, exercise after the meals, and timing of meals) need to be considered along with glycemic results from self-monitoring of blood glucose. These factors are discussed in the following paragraphs.

Carbohydrate Sources to be Limited

These guidelines may be useful when counseling a woman on the carbohydrate content in the meal plan. Eating a diet with high glycemic index food when pregnant with GDM may result in the need for treatment with insulin.⁶⁹ The following foods are rapidly absorbed and can raise the blood glucose more than desired. The initial meal plan should not contain these items. Their use can be individualized and needs to be based on a woman's ability to maintain blood glucose control and weight gain goals, while consuming a nutritionally adequate prenatal diet. In general, limit:

- ❖ Refined sugars such as honey, sugar, molasses, corn sweeteners and sugary desserts.
- ❖ Fruit juices, regular sodas, energy drinks, sports drinks, sweetened coffee drinks, and refined starches such as highly processed breakfast cereals, instant potatoes and instant noodles.

Recommended Carbohydrate Sources

- ❖ Slowly digested carbohydrate sources from the Starch/Bread exchange group, specifically those that have a low glycemic index and are high in fiber and less dense are the best choices. These include old-fashioned oatmeal, whole grain breads, legumes (dried cooked whole beans, peas, lentils), and pasta.
- ❖ Fresh fruits are included in limited amounts, with no more than one exchange per meal or snack. Avoiding fruit at the first meal of the day may improve post breakfast glycemic control.
- ❖ Fresh vegetables are recommended in liberal amounts, especially broccoli, spinach, and greens.
- ❖ Milk may be included as either 1% fat or fat-free in portion sizes of 4-8 ounces per meal or snack. Many women find that excluding milk (lactose) from the breakfast meal improves postprandial glycemic control.

Breakfast

- ❖ For most pregnant women with diabetes, insulin resistance is greater in the morning.^{70,71} Therefore, the breakfast carbohydrate load may need to be restricted to 15 - 30 grams of carbohydrate.⁷⁰
- ❖ Fruit juices, fruits, milk, ready-to-eat or instant cereals, bagels, croissants and rice porridge are usually excluded from the breakfast meal. Self-monitoring of blood glucose is recommended to determine individual tolerance.

Snacks

- ❖ Be aware that having both fruit and milk for the same snack may lead to between meal hyperglycemia that goes unchecked.
- ❖ Allow a 2-3 hour interval between meals and snacks (except for someone who is on glyburide). Snacks should contain a lower amount of carbohydrate than lunch and dinner.
- ❖ A bedtime snack of approximately 7 grams of protein and 15-30 grams of carbohydrate is recommended for women to prevent starvation ketosis and potential middle of the night hypoglycemia, especially for women on glucose-lowering medication.⁷²
- ❖ Allow no more than 10 hours between bedtime snack and breakfast the following morning.²⁹
- ❖ Inclusion of protein in the snack increases satiety.

Women taking rapid-acting insulin to cover a higher carbohydrate breakfast may notice that they experience low blood glucose levels in the mid-morning as the morning insulin resistance wears off and the residual rapid-acting insulin continues to work. Mid-morning carbohydrate snacks may prevent this occurrence. For women using insulin pump therapy, it will be necessary to cover snacks with an insulin bolus based on the carbohydrate content of the snack. A period

of frequent blood glucose monitoring is recommended to determine insulin-to-carbohydrate ratios for these snacks. As long as the diet is adequate, women using insulin pump therapy may be allowed increased flexibility regarding inclusion or exclusion of snacks.

Glycemic Index in the Management and Prevention of Diabetes

The glycemic index (GI) is a ranking system for carbohydrates based on their effect on blood glucose levels in the first two hours. It compares carbohydrates, gram for gram, in individual foods, to provide a numerical index of postprandial (post-meal) glycemia. Carbohydrates that break down rapidly during digestion have the highest glycemic indices. Carbohydrates that break down slowly, releasing glucose gradually into the blood stream, have a low glycemic index.

The use of low-glycemic index diets for the management of diabetes is controversial. The findings of randomized controlled trials have been mixed: some studies have shown statistically significant improvements, whereas other studies have not.⁷³⁻⁷⁵

The European Association for the Study of Diabetes recommends the substitution of low-GI foods. However, the American Diabetes Association (ADA) asserts that there is not sufficient evidence of long-term benefit to recommend their use as a primary strategy, but does acknowledge that use of low-GI foods may reduce postprandial hyperglycemia. The American Diabetes Association's 2007 position statement on Nutrition Recommendations and Interventions for Diabetes, explains that "the use of the glycemic index and [glycemic] load may provide a modest additional benefit [for glycemic control] over that observed when total carbohydrate is considered alone" for individuals with diabetes.²⁸

The glycemic load (GL) is a ranking system for carbohydrate content in food portions based on their GI and the portion size. Glycemic load is calculated by multiplying the GI by the amount of available carbohydrate (grams of carbohydrate not including fiber) provided by a food and dividing by 100.⁷⁶

$$GL = \frac{GI \times \text{grams of available carbohydrate}}{100}$$

In addition to using the individualized meal plan for a woman with diabetes, it may then be prudent to advise her to use her own blood glucose results to determine the effect of various foods on her own blood glucose levels and make modifications in her diet as necessary.

**USE OF DIABETES
MEDICATIONS****Women Using Insulin**

Meal plan recommendations for women with type 1 diabetes are based on the type of insulin therapy used. For women using insulin-to-carbohydrate ratios, premeal and postmeal blood glucose monitoring will be necessary for adjusting these ratios as pregnancy progresses. A thorough understanding of carbohydrate counting is essential when using insulin-to-carbohydrate ratios. The insulin-to-carbohydrate ratio may be different at the breakfast meal due to the increased insulin resistance at this time. For example, the breakfast ratio may be 1 unit of insulin to 10 grams carbohydrate whereas the lunch and dinner ratio is 1 unit of insulin to 15 grams carbohydrate.

For a woman using multiple daily injections or intensive forms of insulin therapy, such as an insulin infusion pump, insulin-to-carbohydrate ratios can be calculated to allow flexibility in carbohydrate intake without sacrificing the tight glycemic control needed during pregnancy. See *Chapter 3: Medical Management and Education for Preexisting Diabetes During Pregnancy* for more information regarding insulin resistance and duration of insulin action.

Glyburide and Meal Planning

Since the landmark study of Langer et al⁷⁷, glyburide use during pregnancy has become more widespread. Glyburide is a second generation sulfonylurea with a long half-life, and consequent high risk for hypoglycemia. Due to its slow rate of absorption and onset of action, glyburide may not restore first phase insulin release when initially prescribed.⁷⁸ As a result, postprandial blood sugars after breakfast may continue to be elevated, and hypoglycemia may occur before lunch unless a snack is introduced on time. Clinicians have reported that the optimal snack time may be as early as 1.5 hours after the initiation of breakfast. Patients who have been prescribed pre-breakfast glyburide need to be educated about the potential for midmorning hypoglycemia. Similarly, with bedtime dosing of glyburide, it is imperative to recommend a bedtime snack to avoid overnight hypoglycemia.

In summary, with the initiation of glyburide, patients need to strictly adhere to a 3 meal, 3-4 snack meal plan in order to avoid hypoglycemia.

Metformin

Using metformin along with diet and exercise does not pose a risk for hypoglycemia. The basic GDM meal plan can be used.

NUTRITION EDUCATION

A woman who plans to be, or is, pregnant and has diabetes may need guidance on specific nutrition issues based on the type of diabetes she has, her current knowledge about nutrition and diabetes, and her specific concerns during pregnancy. Education should include the following issues as appropriate:

- ❖ Rationale for the meal plan includes achieving a preconception weight goal and optimal nutrient intake, maintaining normoglycemia and optimal nutrient intake throughout pregnancy, and attaining appropriate weight gain in each trimester
- ❖ Spacing of meals and snacks to avoid hypoglycemia and hyperglycemia
- ❖ Limitation of foods with high glycemic index such as highly processed breakfast cereals, fruit juices and instant starch products (instant potatoes and instant noodles)
- ❖ Utilization of self-monitoring of blood glucose (SMBG) and food records to problem solve and/or identify blood glucose excursions related to food intake
- ❖ The need for insulin, glyburide, or metformin and adjustments to their dosages
- ❖ The role and timing of exercise to improve blood glucose levels
- ❖ Different methods of carbohydrate counting and meal plan flexibility
- ❖ Use of sugar substitutes
- ❖ Use of herbs
- ❖ The way to read food labels and grocery shopping guidelines
- ❖ Appropriate treatment and prevention of hypoglycemia
- ❖ Menu ideas and restaurant ordering skills (asking for substitutions, salad dressing on the side, etc.)
- ❖ Ways to handle sick days, hyperemesis, and carbohydrate replacement if on glyburide or insulin therapy
- ❖ Long term healthy eating habits to avoid type 2 diabetes or its complications

Education Materials

For access to nutrition education materials including the California MyPlate for Gestational Diabetes resource, please refer to the CDAPP Sweet Success Resource and Training Center website:

- ✓ <http://www.cdappsweetsuccess.org/Resources/FreePatientEducationMaterial.aspx>
- ✓ <http://www.cdph.ca.gov/programs/NutritionandPhysicalActivity/Documents/MO-NUPA-MyPlateforGestationalDiabetes.pdf>

GESTATIONAL DIABETES MELLITUS

Currently the International Association of Diabetes and Pregnancy Study Groups (IADPSG) recommends using a 75 gram 2 hour Oral Glucose Tolerance Test (OGTT) to test for gestational diabetes at 24 -28 weeks gestation.⁷⁹ Based on the previously recommended 3 hour OGTT, a study by Langer and colleagues⁸⁰ showed that women with one abnormal OGTT value who did not receive treatment had higher incidence of metabolic complications and larger infants. The women

who received treatment had significantly better neonatal outcomes. In addition, rates of hypertension and caesarean sections were also higher in women with one abnormal glucose value.^{8,1} Therefore, it is clear that women with one abnormal glucose value during pregnancy should be treated similarly to women with GDM.

Research has shown that MNT is the primary intervention in the management of GDM.² Similarly, the Academy of Nutrition and Dietetics nutrition practice guidelines for GDM utilized by registered dietitians in obstetric clinics resulted in improved perinatal outcomes.¹

The blood glucose goals are the same for a woman with GDM as for a pregnant woman with preexisting diabetes. Some women will be able to achieve these goals through medical nutrition therapy and exercise while others will need MNT and exercise plus insulin, glyburide or metformin. Self-monitoring of blood glucose levels is essential in this group of women to demonstrate continued maintenance of normoglycemia as the pregnancy progresses.

OPTIMIZING GLYCEMIC CONTROL

Here are some summary points from the previous discussion to help with maximizing optimal glycemic control.

- ❖ Emphasize a consistent schedule of daily meals and snacks. For a woman with preexisting diabetes, it would be beneficial to help her develop eating habits that can be carried over into pregnancy so that only minimal diet adjustment is required during the first trimester. As pregnancy progresses, add incremental kilocalories, as needed, to maintain optimum weight gain.
- ❖ Suggest that the woman distribute food intake over three meals and several snacks for prevention of hypoglycemia (especially for women taking glyburide or multiple daily injections of insulin).
- ❖ If a woman is using insulin or glyburide, ask her to keep her carbohydrate intake consistent in order to establish the correct insulin or glyburide dose needed. Daily food records plus premeal and postmeal blood glucose values are very useful for evaluating how to adjust insulin or glyburide and/or meals.
- ❖ Identify individual glycemic responses to foods by reviewing the woman's daily food records. Synchronize food intake with insulin or glyburide action, exercise and other variables.
- ❖ Determine the cause of aberrant blood glucose values which can be due to changes in food intake (extra carbohydrate, snacks too close to meals, skipped snacks), exercise, insulin or glyburide, or illness. Other variables such as increased pregnancy hormone levels could explain gradually increasing blood glucose levels.
- ❖ Share recommendations with the health care team regarding changes in the MNT plan that may affect the dosage of insulin or glyburide, or the need to initiate insulin or glyburide therapy.

- ❖ Help the woman with preexisting diabetes, especially a woman with type 1 diabetes, develop a plan for using carbohydrate-to-insulin ratios so insulin can be adjusted to the diet.⁸² This involves more intensive education about carbohydrate counting and nutrient management provided by the RD and other members of the health care team.

EVALUATION OF MEDICAL NUTRITION THERAPY GOALS

Evaluation of the MNT goals should be reviewed and adjusted at least once a month after the meal plan is in place according to the parameters found in Table 7. Glucose intolerance worsens as pregnancy progresses due to increased hormone production. The RD should reassess the woman's adherence to her meal and exercise plan as well as other nutrition related issues. If review of food records indicates adherence to the meal plan and if glucose intolerance continues, the RD should collaborate with the health care team regarding initiating or adjusting insulin, glyburide or metformin.

Outcome	Process
Adequate nutrient intake	Review food records for adequate nutrient intake to meet the Daily Reference Intakes (DRI - formerly RDA). The California MyPlate for Gestational Diabetes can be used to educate patients regarding sufficient nutrient intake. Refer to: http://www.cdph.ca.gov/programs/NutritionandPhysicalActivity/Documents/MO-NUPA-MyPlateforGestationalDiabetes.pdf
Appropriate weight gain	Check weight and plot on a grid. Address excess or inadequate weight gain by reviewing food records to estimate amount of kilocalories. Adjust meal plan as needed.
Blood glucose in target range	Review blood glucose records and food records to identify reasons for elevated blood glucose levels after meals. Assess the woman's ability to follow her meal plan and make appropriate food choices. Assess whether insulin orders need to be requested.
Limit episodes of hypoglycemia in women requiring insulin	Review prevention and treatment of hypoglycemia. Assess woman's ability to identify reasons for hypoglycemic episodes and ability to prevent re-occurrence (e.g. skipped meal or snack, excessive insulin dose, or extra exercise).

Pregnant women with diabetes may have complicating conditions that require specialized nutrition assessments (e.g. renal disease, eating disorders). These women should be referred to a RD specializing in these areas of dietetics.

**SPECIAL NUTRITION
ISSUES IN DIABETES
AND PREGNANCY****Dyslipidemia**

Women with GDM and type 2 diabetes often have dyslipidemia and a high risk for cardiovascular disease (CVD). In general, limiting total fat is a good recommendation for persons at high risk for CVD. Limiting total fat may not be best for patients with high triglycerides and/or low High Density Lipoprotein (HDL). Therefore, a diet lower in carbohydrates and higher in monounsaturated fats is recommended.⁸³ Additionally, limiting saturated fats to no more than 7% of the total fat intake is helpful in controlling dyslipidemia.⁸⁴

Chronic Hypertension

Although no evidence exists regarding the effectiveness of diet modifications to prevent preeclampsia, dietary modifications have been shown to lower blood pressure in the nonpregnant state.⁸⁵ For women previously identified with chronic hypertension, it would seem prudent to incorporate the nutrition principles that have been recognized to lower blood pressure. The Dietary Approaches to Stop Hypertension (DASH) study demonstrated a decrease in diastolic and systolic blood pressures within 2 weeks of making dietary changes.⁸⁵ The DASH diet averages 7-8 servings of grains, 4-5 servings of fruits, 4-5 servings of vegetables and 2-3 servings of low fat dairy foods daily. Fish, poultry and nuts were also included; red meat, sweets and sugar-sweetened drinks were limited.⁸⁶

Post-Bariatric Surgery

Nutrition considerations related to pregnancy after bariatric surgery are directly related to the type of bariatric surgery performed. Types of bariatric surgery fall into two main classifications: restrictive surgery and malabsorptive surgery.

Restrictive bariatric surgery slows the emptying time of the stomach portion of the gastrointestinal tract and may reduce the size of the stomach. Two common forms are adjustable gastric banding (AGB), also known as lap band, and vertical banded gastroplasty (VBG). AGB creates a small pouch of stomach that holds approximately 1 ounce of food. A constrictive hollow band is placed at the low end of the small pouch and is inflated with saline solution. Patients can usually eat up to $\frac{3}{4}$ cup of food before they begin to feel full. The VBG works in a similar manner; however, a combination of a hollow band and staples is used to achieve the same result.

Two common malabsorptive surgeries are Roux-en-Y gastric bypass (RGB) and biliopancreatic diversion (BPD). These surgeries bypass all or part of the small intestine resulting in food restriction and

malabsorption. Not only is the volume of food and nutrients reduced but so is the absorption of important protein, vitamins and minerals. There is a higher risk of nutritional deficiencies with malabsorptive bariatric procedures.

❖ **Planning Pregnancy after Bariatric Surgery**

Approximately 83% of bariatric surgery patients are women and many are of childbearing age. Pregnancy after bariatric surgery should not be attempted until weight loss and nutritional intake have been stabilized. Therefore, it is highly recommended that women who have had bariatric surgery wait at least 18 months before attempting pregnancy.⁸⁷ Foods that can be difficult to tolerate during the year post surgery include fruits, vegetables and protein source foods, all of which are essential for a healthy pregnancy.

Although future studies are warranted, one study by Sheiner et al has found that “previous bariatric surgery in patients with gestational diabetes mellitus is not associated with adverse perinatal outcome.”⁸⁸ However, standard testing for gestational diabetes can become problematic for some pregnant women after bariatric surgery. A glucose tolerance test can bring on symptoms of dumping syndrome with nausea, abdominal cramps, diarrhea, and heart palpitations. It is recommended to perform self-glucose monitoring with individualized MNT and not use the Glucose Tolerance Test.

After bariatric surgery, women who are contemplating becoming pregnant should be strongly encouraged to undergo preconception nutritional assessment and counseling. Laboratory data will assist in this assessment. Ideally, the time to correct nutritional problems is preconception, making pregnancy planning the most sensible approach. Taking multivitamins in the chewable or liquid form improves ingestion and prevents blockage for individuals who have undergone bariatric surgery. Prenatal vitamins should be given in addition to the women’s usually prescribed vitamin and mineral supplementation and not instead of that supplementation.⁸⁹ In an article on pregnancy post-bariatric surgery, Edwards explains that “Poststabilization, patients can usually ingest as much as 1200 calories/day.” She continues by saying, “Wise selection of proteins, complex carbohydrates and healthy fats is imperative.”⁸⁹ Vitamins and minerals are of particular importance during pregnancy after bariatric surgery and include^{89,90}:

- ❖ **Calcium:** In reference to calcium, Edwards continues to explain that “Postbariatric pregnant women many require between 1,200-1,500 mg of calcium in order to meet personal skeletal needs and needs for mineralization of the fetal skeleton. Calcium citrate with Vitamin D is the optimal form of calcium for bariatric patients since it does not require an acidic environment for metabolism to take place.”^{89,90}

- ❖ **Folic Acid:** Reaching the levels for enough folate absorption in an individual after bariatric surgery is a subject of concern. Often foods that are high in folic acid are poorly tolerated such as enriched breads or cereals, broccoli, lentils, peanuts, spinach, orange juice and asparagus. Some of these foods may also circumvent the duodenum. To ensure nutritional folate needs are reached, serum blood levels should be evaluated.^{89,90} Homocysteine may be the most sensitive marker of folic acid status in conjunction with erythrocyte folate.⁹¹ Supplementation of 1 mg/day of folic acid will treat and/or prevent a deficiency. Greater than 1 mg/day is not recommended unless there is a medical indication, such as having a past pregnancy with a baby with a neural tube defect.
- ❖ **Iron:** Two possible causes of iron deficiency after bariatric surgery is malabsorption and decreased nutritional intake. Edwards notes that “Iron in the form of ferrous fumarate, [at a dose of] 40 to 64 mg, is best tolerated and absorbed because the iron has already been broken down from the ferric state making absorption more effective.”^{89,90} Patients who have undergone restrictive bariatric surgery do not always need as much iron supplementation. Regardless, to establish sufficient iron intake, intermittent hemoglobin levels should be measured.^{89,90}
- ❖ **Vitamin B12:** Vitamin B12 absorption is greatly affected by the malabsorptive form of bariatric surgery due to lack of intrinsic factor. Early pregnancy loss is correlated with raised serum homocysteine levels which can be a result of Vitamin B12 deficiency. For women, 350 mcg of crystalline Vitamin B12 should be daily taken. To establish sufficient Vitamin B12 intake, serum cobalamin levels should be intermittently measured and evaluated.^{89,90}
- ❖ **General Guidelines for Post-Bariatric Surgery**
Within the medical community, standardized and science-based guidelines encircling nutrition for patients after bariatric surgery do not exist.⁹² However, here are some recommended general guidelines that pertain to pregnant women who have had bariatric surgery.
 - Protein should be eaten prior to fats and carbohydrates, in the amount of 60-80 grams of protein per day.
 - Each meal should take 20-30 minutes to eat, to avoid bolus eating and to allow the individual to feel full.
 - Food should be eaten in small amounts and thoroughly chewed.
 - Liquids should be avoided during meals. Ingest liquids 30-60 minutes before or after meals.
 - Drink only sugar-free, caffeine-free or decaffeinated, non-carbonated beverages.
 - Eat three to six small meals per day.
 - Avoid chewing gum, as an obstruction can occur if swallowed.

Ketosis

Ketones in the urine may be the result of inadequate kilocalorie and/or carbohydrate intake or over-exercising. This occasionally occurs when the woman restricts foods to control blood glucose levels in order to avoid the use of glyburide or insulin therapy. Other reasons for the presence of urine ketones might be a misunderstanding of the meal plan pattern, carbohydrate food choices, and/or inappropriate portion sizes. Checking the fasting urine for ketones may be a rapid method for the RD to assess whether the woman is knowingly or unknowingly restricting her intake of kilocalories and/or carbohydrate.⁹³

In normal pregnancy, ketones will be present in the urine after a 14-hour fast. This state is referred to as ketosis. The goal is for the fasting urinary ketone levels to be none or trace. If moderate or large amounts of urine ketones are found, the RD needs to refer the patient for medical management.

In the case of gestational diabetes, routine urine ketone testing is not recommended unless there is persistent weight loss or a particular need to identify whether the woman is consuming adequate kilocalories and/or carbohydrates.

Ketone testing is recommended in women with type 1 diabetes who are poorly controlled or newly diagnosed. Stress hormones or illness will aggravate insulin resistance. According to Kitibachi et al, diabetic ketoacidosis (DKA) “consists of the biochemical triad of hyperglycemia, ketonemia and acidemia.”⁹⁴ DKA can occur with blood glucose levels as low as 180 to 200mg/dL in pregnancy.⁹⁵ DKA in pregnancy is usually associated with type 1 diabetes but there have been cases of DKA diagnosed in women with GDM as well.⁹⁶ DKA is a medical emergency, one of the most serious acute complications of diabetes. Any suspicion of DKA should be referred to the healthcare provider immediately. For more information, refer to *Chapter 3: Medical Management and Education for Preexisting Diabetes During Pregnancy*.

Sick Day Nutrition Management

Any woman with diabetes, who becomes ill during pregnancy, and especially one using glyburide or insulin, needs to be instructed on substituting easily digested carbohydrate foods as a replacement for the carbohydrates in her prescribed meal plan. Sick day nutrition management instructions for the pregnant woman who requires glyburide or insulin therapy are:

- ❖ Continue consumption of regularly scheduled meal plan and drink plenty of fluid if tolerable.⁹⁷
- ❖ If unable to follow the regularly scheduled meal plan, eat or drink to stay hydrated and maintain euglycemia. Include small amounts of carbohydrate containing foods or liquids as tolerated

to equal 15 grams of carbohydrate every 2 to 3 hours.⁹⁷ Tolerated foods often include: 6 saltine crackers, 1 slice of toast, 2/3 cup chicken noodle soup, 1/2 cup serving of regular gelatin, applesauce, juice, custard, pudding, ice cream, sherbet, frozen yogurt or regular soda.

- ❖ If vomiting, diarrhea or fever is present, add sugar-free and caffeine-free liquids to the tolerated foods to prevent dehydration. Examples of these liquid choices are: water, sugar-free Kool-Aid, Crystal Light, and caffeine-free/sugar-free tea or soda. A sodium-rich choice such as bouillon can be substituted for this liquid every third hour.
- ❖ Blood sugar levels need to be checked more often (at least every 2- 4 hours).⁹⁷
- ❖ Women with type 1 diabetes may be advised to test for urine ketones every 4 hours or until negative.⁹⁷
- ❖ Contact the health care provider if: unable to retain food or liquids for 1/2 hour in a 2 hour period, temperature > 100° F, blood glucose values are elevated above 200 mg/dL⁹⁸, or urine ketones are moderate to large or blood ketones are >0.6 mmol/L.^{95,97}
- ❖ If a woman is on glyburide or insulin therapy, contact the health care team when ill for more than one day. Insulin therapy should continue and insulin doses often need to be adjusted during this time.

POSTPARTUM NUTRITION ISSUES

Postpartum Nutritional Issues for Women with GDM

Several studies were analyzed by the Academy of Nutrition and Dietetics Evidence Analysis Library in which weight-loss following a pregnancy with GDM was associated with a reduced risk of developing type 2 diabetes.⁴⁷ The children of women with a history of GDM are also at an increased risk for obesity and diabetes.⁹⁹

Type 2 diabetes may be prevented through lifestyle changes. In the Diabetes Prevention Program, a high percentage of study participants lost 7 percent of their body weight by following a low-fat, low-calorie meal plan and doing 150 minutes of moderate physical activity each week. The study participants, which included several hundred women with a history of GDM, were able to reduce their risk for type 2 diabetes by 58 percent.¹⁰⁰ For early detection, it is crucial that women who have had GDM have an annual screen for diabetes.

Emphasis on the following guidelines may delay or prevent the later onset of diabetes in this group of high-risk women:

- ❖ Eat a nutritionally balanced diet by including a variety of food groups in each meal.
- ❖ Adjust kilocalorie intake to achieve a reasonable body weight.
- ❖ Include aerobic exercise daily.
- ❖ Limit animal fats, saturated fats, and trans-fats in the diet.

For the woman who no longer has diabetes after the birth of her baby, nutrition guidelines can be based on the Dietary Recommendations for Americans, the California MyPlate for Gestational Diabetes and the Academy of Nutrition and Dietetics guidelines. These guidelines encourage inclusion of a variety of foods and emphasize lower fat and higher fiber intake. A woman's culture and personal food habits should be taken into consideration to individualize the recommendations. A postpartum visit offers an opportunity to counsel the woman on the importance of healthy eating habits and exercise to lower the risk of developing diabetes.

A woman who had prediabetes prior to pregnancy or gestational diabetes during pregnancy requires diagnostic testing during the 6 weeks postpartum period to assess whether she has converted to type 2 diabetes. If this has occurred, she will need medical counseling and a MNT plan.

Preexisting Diabetes

A woman with preexisting type 1 diabetes or type 2 diabetes, regardless of her choice to breastfeed, needs a MNT plan for postpartum use to meet nutrition and glycemic goals. It is recommended that the plan focus on the woman's goals for a healthy lifestyle, such as gradual weight loss if needed, blood glucose control, and exercise. The American Diabetes Association nutrition guidelines can be used to help set postpartum targets and to develop a meal plan that meets required changes in kilocalories, medication and activity.^{7,10} Self-monitoring of blood glucose can provide feedback to the RD and the woman on how these changes are meeting the MNT. The RD, as part of the team, should reinforce the importance of planning future pregnancies and encourage optimal blood glucose control before conception to reduce the risk of congenital anomalies.

Pre-diabetes

Pre-diabetes is a condition where blood glucose levels are higher than normal, but not high enough for a diagnosis of diabetes. Perinatal mortality rate increases with pre-diabetic pregnancies, and this rate increases steadily until the time of diagnosis of diabetes. Wood et al conclude that “insulin resistance, coupled with the added burden of pregnancy, leads, in some subjects, to the inability of pancreatic beta cells to maintain glucose homeostasis, and ultimately to hyperglycemia.”¹⁰¹

The nutrition guidelines for women with pre-diabetes planning pregnancy are:

- ❖ Follow a healthy, low-fat diet that includes small portions of starchy foods and more of the high fiber foods.
- ❖ Minimum of 30 minutes of exercise every day
- ❖ If overweight, lose at least 5-10% of current weight
- ❖ Maintain A1c values <6.0%

**HEALTHY EATING
DURING
LACTATION**

Postpartum nutrition guidelines for women with diabetes who are breastfeeding are outlined in this section.

Encourage the woman with either preexisting diabetes or GDM to breastfeed for both the maternal and infant benefits which are outlined in *Chapter 8: Breastfeeding*. Nutrition requirements for a woman during lactation following a diabetic pregnancy are discussed below. Whether a woman with diabetes chooses to breastfeed or not, she will need nutritional guidance and a MNT plan during the postpartum period to meet her changing needs.

The energy requirements of lactating women are met primarily from the diet but may also be met by the mobilization of tissue stores.¹⁰² The average milk production is 0.78 L/d from birth to 6 months and 0.6 L/d from 7 through 12 months.

Average weight loss during the first six months postpartum is 0.8 kg/month or 170 kcal/day. Milk energy output is estimated at 500 kcal/day in the first 6 months and 400 kcal/day in the second 6 months.

The minimum caloric intake of 1800 kcal/day will usually meet the requirements for energy during lactation while promoting a weight loss of 1-2 lbs/month.¹⁰³ A folic acid supplement with 500 mcg either in the form of a vitamin pill or fortified cereal is recommended during lactation as with all women of child bearing age.

Additional protein is necessary during lactation for conserving skeletal muscle. The RDA for protein is the same for diabetic and non-diabetic women; which is 1.1 g/kg/day or +15-20 g/day of additional protein over non-pregnant requirements.¹⁰⁴ This is the same as during the last half of pregnancy.

The requirement for carbohydrate (CHO) is increased during lactation. Additional CHO is necessary to prevent utilization of the endogenous proteins for lactose synthesis. The RDA for CHO during lactation is 210 g/day.⁴¹

Table 8 summarizes recommendations for healthy eating while lactating.

Table 8. GENERAL SUGGESTIONS FOR HEALTHY EATING WHILE LACTATING
<ul style="list-style-type: none"> ❖ Follow the meal plan for pregnancy: three small meals and three or more snacks every day. ❖ Drink water and other sugar-free, non-caffeine containing beverages for thirst – including, but not limited to, milk. ❖ Choose foods low in fat and high in fiber, such as vegetables, fruits, whole grain cereals or breads, and beans or legumes. ❖ Choose smaller portions and limit second helpings. ❖ Choose whole grains instead of white processed grains. ❖ Avoid sweetened drinks and juice. ❖ Avoid alcohol. ❖ Use low-fat and nonfat dairy products such as fat-free milk, 1% milk, part-skim mozzarella cheese and nonfat yogurt. Choose pasta and sauces without fats or cheese. ❖ Avoid processed food, especially those made from partially hydrogenated oils such as baked products (cakes, pies, etc.), crackers and doughnuts. ❖ Choose lean meats. Limit the amount of lean meats you eat to 3 ounces per meal (size of a deck of cards). ❖ Follow guidelines for fish as mentioned under “Omega-3 Fatty Acids.” ❖ Use less oil, margarine, lard and butter when you cook and add less to foods. ❖ Use healthy oils such as canola and olive oil to replace shortening and butter. ❖ Measure the fat you use. For example: one teaspoon is equal to 5 grams of fat, one tablespoon is equal to 15 grams of fat. ❖ Consume one source of 500 mcg of synthetic folic acid daily, in addition to a diet rich in natural folate.

When breastfeeding is not an option use preconception dietary guidelines found in Table 6.

Weight Loss to Attain a Normal BMI

Gradual weight loss at the rate of one to two pounds per month (approximately 1.0 kg per month) appears to be consistent with maintaining adequate milk volume in a normal weight woman who is working on losing the extra weight she gained during pregnancy. An overweight woman can lose up to 4.5 pounds per month (approximately 2 kg per month) without adversely affecting milk volume.¹⁰⁵ Rapid weight loss greater than 4.5 pounds or 2 kg per month is generally not recommended for a breastfeeding woman. The metabolic cost of producing human milk is similar to the energy cost of the third trimester of pregnancy. To ensure adequate nutrition during the early postpartum period, meal plans should be individualized. Kilocalories should come from appropriate food choices that have a high nutrient density and be individualized to meet actual energy needs and weight goals.

Snacks

Since glucose is preferentially shunted towards production of breast milk, women with diabetes (and especially women with type 1 diabetes) are more prone to hypoglycemia during lactation. Snacks may be needed to prevent hypoglycemia in the early postpartum period and

throughout lactation. The woman should be counseled to eat snacks during or before breastfeeding and before naps to avoid hypoglycemia. Suggested snacks should contain:

- Carbohydrate: 1-2 exchanges (15-30 grams)
- Protein: 1 exchange (7 grams)

If the infant is night feeding, a snack of 1 carbohydrate exchange (15 grams) can be added. Other snacks may be added if hypoglycemia is a problem.

Alcoholic Beverages

Because the consumption of alcoholic beverages has been associated with hypoglycemia, increased insulin response¹⁰⁶, possible impairment of milk ejection reflex and the baby's sleep-wake pattern, avoidance of alcohol for the duration of lactation is suggested. Alcohol is transferred into breastmilk.

Nonnutritive Sweeteners

The nonnutritive sweeteners saccharin, acesulfame-K and aspartame cross into breast milk.¹⁰² The effect of these sweeteners on the infant is unknown. Stevia-derived sweeteners, including stevia glycosides and rebaudioside A (Reb A), are generally considered safe in pregnancy and lactation when used in moderation.⁴⁴ As with any herbal medications and dietary supplements that have not yet been approved by the FDA, patients should be cautious with the use of stevia in its whole herb form in pregnancy and lactation, especially when taking anti-diabetic and/or anti-hypertensive drugs (See Table 6). A woman who has phenylketonuria (PKU) or who has an infant with PKU, should not use aspartame as a nonnutritive sweetener.

Supplements

The Dietary Reference Intake of iron for lactating mothers 18 years or less is 10 mg/day. For mothers 19-50 years, 9 mg/day are recommended.⁵³ If dietary intake does not meet this recommended level, supplementation may be necessary. The additional iron found in prenatal supplements is not recommended during lactation unless a woman is anemic (Hgb 11, 10.5 and 11g/dL for the first, second and third trimesters, respectively).

The Dietary Reference Intake of folate for all lactating mothers is 500 mcg/day.⁵³ A folic acid supplement with 400 mcg either in the form of a vitamin pill or fortified cereal is recommended as long as she is of childbearing age.

Use of Herbs and Other Supplements

Health care providers should assess a woman's dietary supplement intake for safety and learn more facts about the dietary supplements a woman may be using. Dietary supplements may include vitamins, minerals, herbs, other botanicals, and amino acids.

Although herbs are considered a component of complementary and alternative medicine, they are not always safe, especially for pregnant or breastfeeding mothers. The Food and Drug Administration (FDA) and other professional organizations have recommended limiting the use of herbal supplements by women during pregnancy because the potential risks of most herbs in pregnancy have not been carefully examined.¹⁰⁷ Consult with a licensed health care professional who is trained in using herbs before making any recommendations on the use of natural medicine or herbs during pregnancy and/or lactation. To stay up with the newest information consult:

- ✓ <http://ods.od.nih.gov/>.

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APPENDICES

A - Prenatal Weight Gain Grids

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Appendix A 1

PRE-PREGNANCY NORMAL WEIGHT RANGE
 Prenatal Weight Gain Grid (1)
 Recommended Weight Gain (2): Single 25-35 lbs; Twins 37-54 lbs

NAME: _____

EDC: _____

DATE	WEIGHT	WEEKS GESTATION	INITIALS

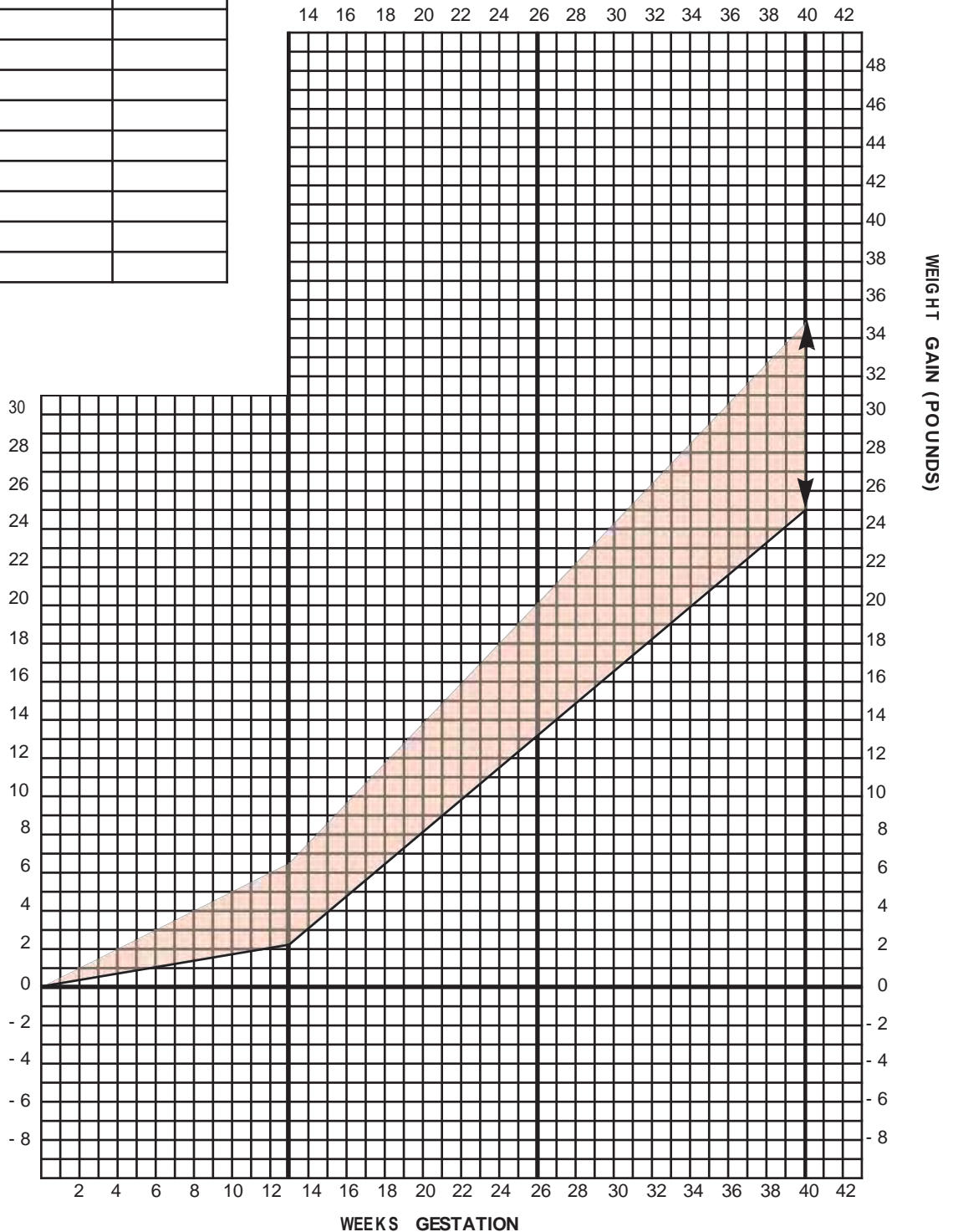
Height	Under Weight (BMI < 18.5)	Normal Weight (BMI 18.5-24.9)	Over Weight (BMI 25-29.9)	Obese (BMI ≥ 30)
4'7"	<80	80-107	108-128	>128
4'8"	<83	83-111	112-133	>133
4'9"	<86	86-115	116-138	>138
4'10"	<89	89-119	120-143	>143
4'11"	<92	92-123	124-148	>148
5'	<95	95-127	128-153	>153
5'1"	<98	98-132	133-158	>158
5'2"	<101	101-136	137-163	>163
5'3"	<105	105-140	141-169	>169
5'4"	<108	108-145	146-174	>174
5'5"	<111	111-149	150-179	>179
5'6"	<115	115-154	155-185	>185
5'7"	<118	118-159	160-191	>191
5'8"	<122	122-164	165-196	>196
5'9"	<125	125-168	169-202	>202
5'10"	<129	129-173	174-208	>208
5'11"	<133	133-178	179-214	>214
6'	<137	137-183	184-220	>220
6'1"	<140	140-189	190-227	>227
6'2"	<143	143-194	195-233	>233
6'3"	<148	149-199	200-239	>239

BMI = Weight (lbs)/Height (inches)² X 703

PREPREGNANCY

WEIGHT: _____

HEIGHT: _____



1. Per personal communication with the Committee to Reexamine IOM Pregnancy Weight Guidelines.
2. Institute of Medicine and National Research Council, Rasmussen KM, Yatkin AL, eds. *Weight Gain During Pregnancy: Reexamining the Guidelines*. Washington, DC: The National Academies Press; 2009.

Appendix A2

PRE-PREGNANCY UNDERWEIGHT RANGE
 Prenatal Weight Gain Grid (1)
 Recommended Weight Gain (2): Single 28-40 lbs; Twins N/A

NAME: _____

EDC: _____

DATE	WEIGHT	WEEKS GESTATION	INITIALS

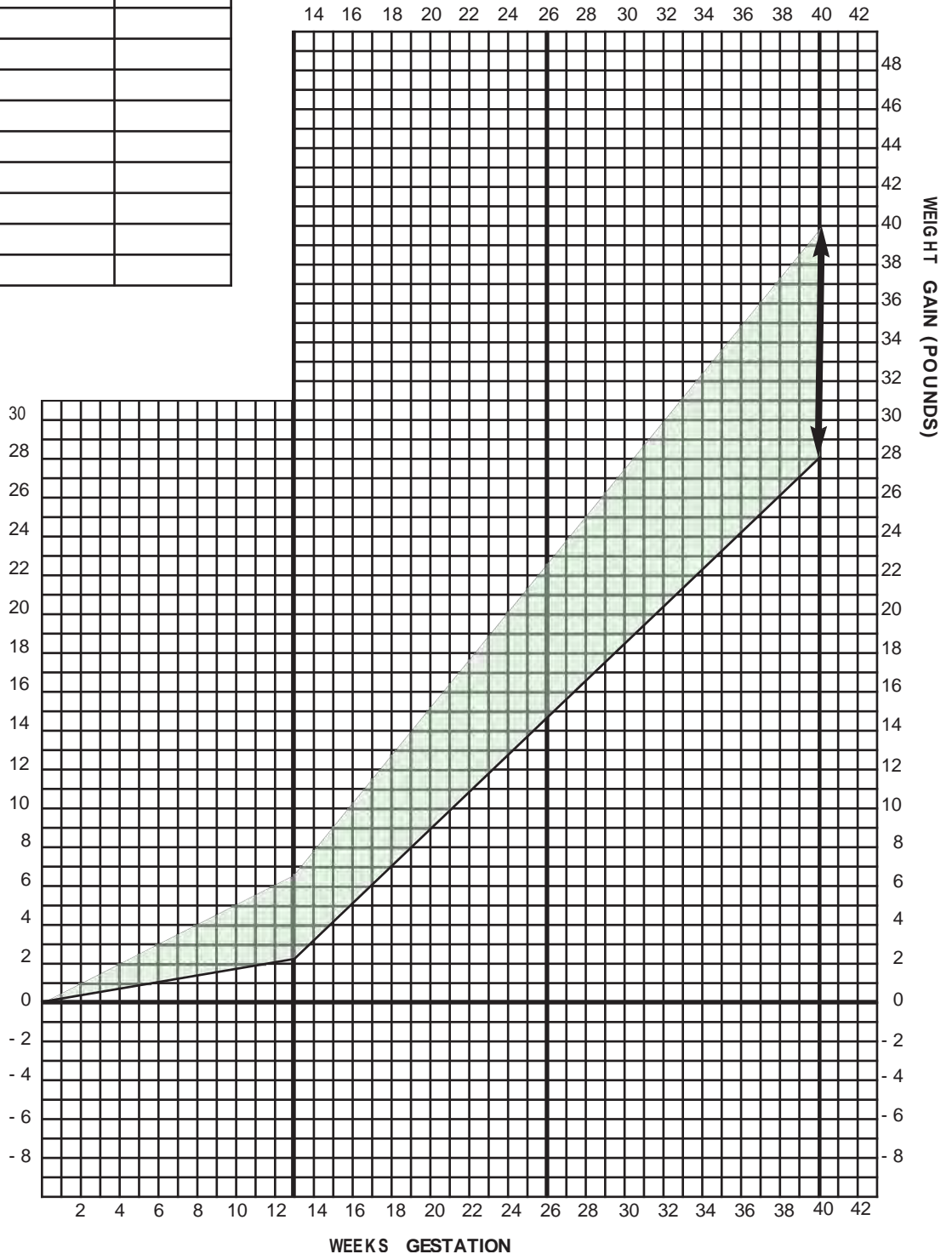
Height	Under Weight (BMI < 18.5)	Normal Weight (BMI 18.5-24.9)	Over Weight (BMI 25-29.9)	Obese (BMI ≥ 30)
4'7"	<80	80-107	108-128	>128
4'8"	<83	83-111	112-133	>133
4'9"	<86	86-115	116-138	>138
4'10"	<89	89-119	120-143	>143
4'11"	<92	92-123	124-148	>148
5'	<95	95-127	128-153	>153
5'1"	<98	98-132	133-158	>158
5'2"	<101	101-136	137-163	>163
5'3"	<105	105-140	141-169	>169
5'4"	<108	108-145	146-174	>174
5'5"	<111	111-149	150-179	>179
5'6"	<115	115-154	155-185	>185
5'7"	<118	118-159	160-191	>191
5'8"	<122	122-164	165-196	>196
5'9"	<125	125-168	169-202	>202
5'10"	<129	129-173	174-208	>208
5'11"	<133	133-178	179-214	>214
6'	<137	137-183	184-220	>220
6'1"	<140	140-189	190-227	>227
6'2"	<143	143-194	195-233	>233
6'3"	<148	149-199	200-239	>239

BMI = Weight (lbs)/Height (inches)² X 703

PREPREGNANCY

WEIGHT: _____

HEIGHT: _____



1. Per personal communication with the Committee to Reexamine IOM Prepregnancy Weight Guidelines.
2. Institute of Medicine and National Research Council, Rasmussen KM, Yatkina AL, eds. *Weight Gain During Pregnancy: Reexamining the Guidelines*. Washington, DC: The National Academies Press: 2009.

APPENDIX A3

PRE-PREGNANCY OVERWEIGHT RANGE

Prenatal Weight Gain Grid (1)

Recommended Weight Gain (2): Single 15-25 lbs; Twins 31-50

NAME: _____

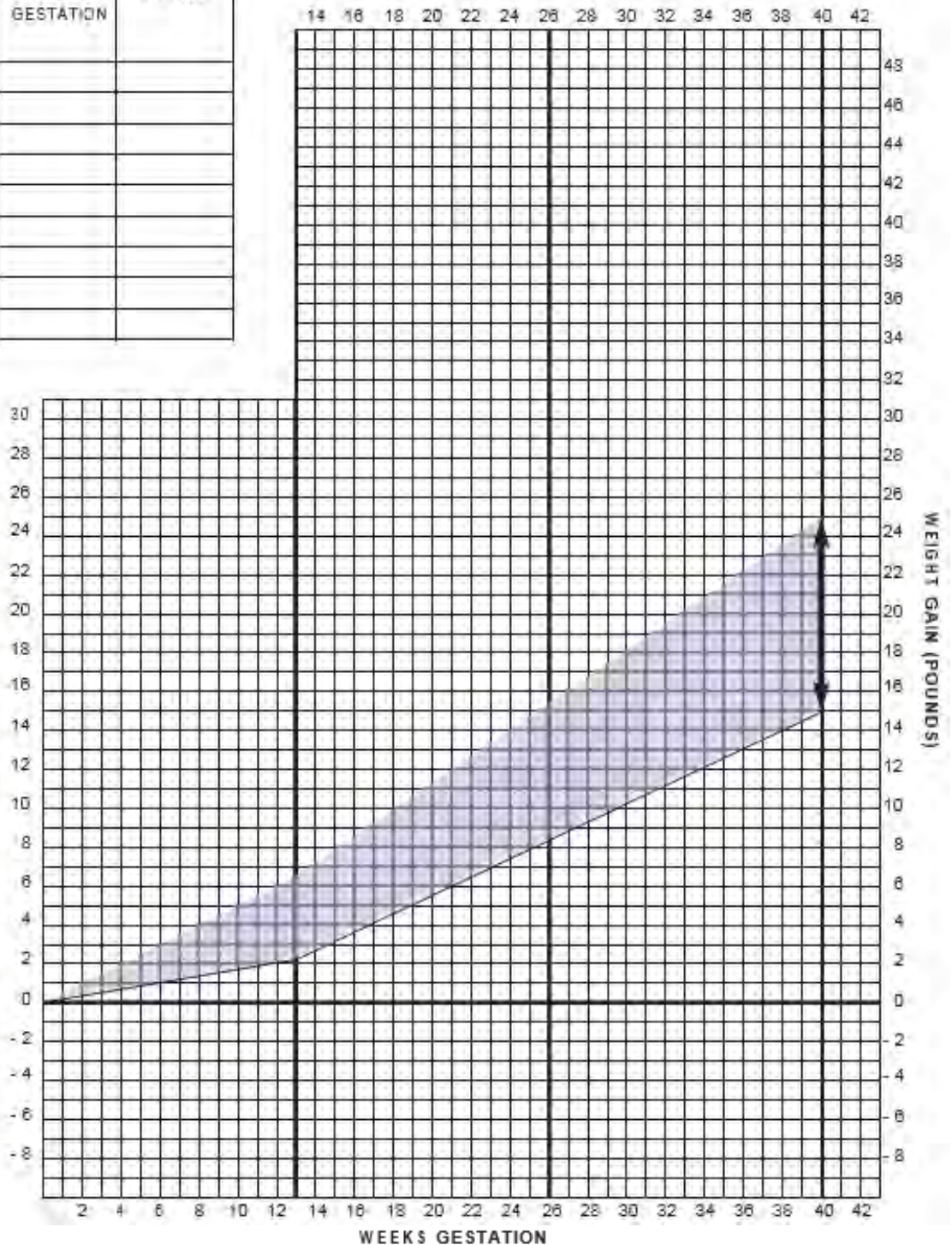
EDC: _____ HEIGHT: _____

PREPREGNANCY WEIGHT _____

DATE	WEIGHT	WEEKS GESTATION	INITIALS

Height	Under Weight (BMI < 18.5)	Normal Weight (BMI 18.5-24.9)	Over Weight (BMI 25-29.9)	Obese (BMI ≥ 30)
4'7"	<80	80-107	108-129	>128
4'8"	<83	83-111	112-133	>133
4'9"	<86	86-113	116-138	>138
4'10"	<89	89-119	120-143	>143
4'11"	<92	92-123	124-148	>148
5'	<95	95-127	128-163	>153
5'1"	<98	98-132	133-168	>158
5'2"	<101	101-136	137-173	>163
5'3"	<105	105-140	141-188	>169
5'4"	<108	108-145	146-174	>174
5'5"	<111	111-149	150-179	>179
5'6"	<115	115-154	155-185	>185
5'7"	<118	118-159	160-191	>191
5'8"	<122	122-164	165-196	>196
5'9"	<125	125-168	169-202	>202
5'10"	<129	129-173	174-208	>208
5'11"	<133	133-178	179-214	>214
6'	<137	137-183	184-220	>220
5'1"	<140	140-189	190-227	>227
6'2"	<143	143-194	195-233	>233
6'3"	<148	149-199	200-239	>239

BMI = Weight (lbs)/Height (inches)² X 703



1. Per personal communication with the Committee to Reexamine IOM Prepregnancy Weight Guidelines.
2. Institute of Medicine and National Research Council, Rasmussen KM, Yatkın AL, eds. *Weight Gain During Pregnancy: Reexamining the Guidelines*. Washington, DC: The National Academies Press: 2009.

Appendix A4

PRE-PREGNANCY OBESE WEIGHT RANGE
 Prenatal Weight Gain Grid (1)
 Recommended Weight Gain (2): Single 11-20 lbs; Twins 25-42

NAME: _____

EDC: _____

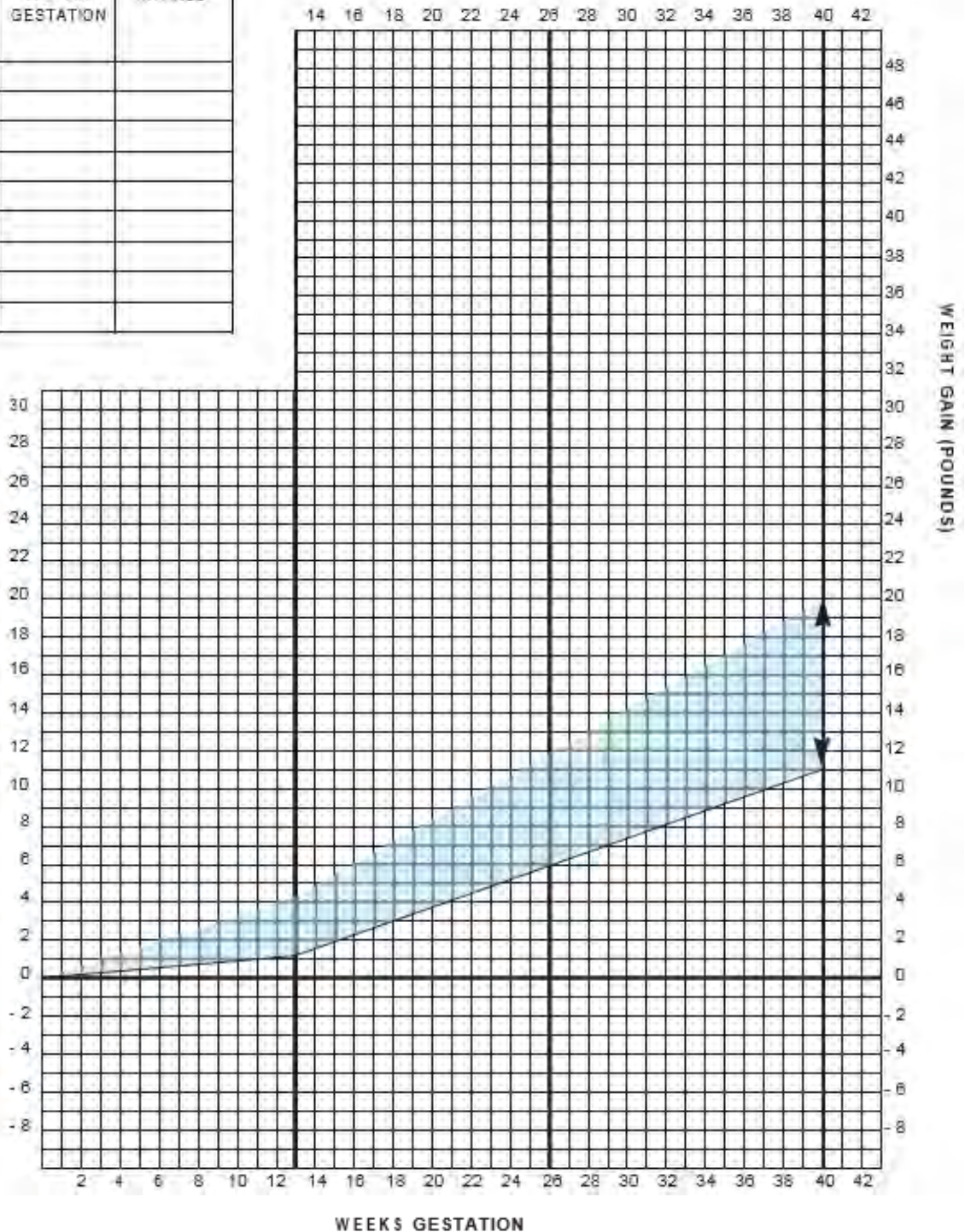
HEIGHT: _____

PREPREGNANCY WEIGHT: _____

DATE	WEIGHT	WEEKS GESTATION	INITIALS

Height	Under Weight (BMI < 18.5)	Normal Weight (BMI 18.5-24.9)	Over Weight (BMI 25-29.9)	Obese (BMI ≥ 30)
4'7"	<80	80-107	108-128	>128
4'8"	<85	85-111	112-133	>133
4'9"	<86	86-115	116-138	>138
4'10"	<89	89-119	120-143	>143
4'11"	<92	92-123	124-148	>148
5'	<95	95-127	128-153	>153
5'1"	<98	98-132	133-158	>158
5'2"	<101	101-136	137-163	>163
5'3"	<105	105-140	141-169	>169
5'4"	<108	108-145	146-174	>174
5'5"	<111	111-149	150-179	>179
5'6"	<115	115-154	155-185	>185
5'7"	<118	118-159	160-191	>191
5'8"	<122	122-164	165-196	>196
5'9"	<125	125-168	169-202	>202
5'10"	<129	129-173	174-208	>208
5'11"	<133	133-178	179-214	>214
6'	<137	137-183	184-220	>220
6'1"	<140	140-189	190-227	>227
6'2"	<143	143-194	195-233	>233
6'3"	<148	148-198	200-239	>239

BMI = Weight (lbs)/Height (Inches)² X 703



1. Per personal communication with the Committee to Reexamine IOM Prenatal Weight Guidelines.
2. Institute of Medicine and National Research Council, Rasmussen KM, Yatkina AL, eds. *Weight Gain During Pregnancy: Reexamining the Guidelines*. Washington, DC: The National Academies Press: 2009.

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▶ CDAPP Sweet Success Guidelines for Care

Chapter 8 Breastfeeding



*Sweet
Success*

— Maternal, Child, Adolescent Health Program —

California Diabetes and Pregnancy Program Sweet Success Guidelines for Care

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8 Breastfeeding

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8 Breastfeeding

INTRODUCTION

Human milk is the normal food of choice to initiate healthy eating for human infants. The American Academy of Pediatrics (AAP) states that “Human milk is species-specific, and all substitute feeding preparations differ markedly from it, making human milk unique and optimal superior for infant feeding.”¹ The institution goes on to note, “Pediatricians and parents should be aware that exclusive breastfeeding is sufficient to support optimal growth and development for approximately the first 6 months of life...” The AAP further states that “breastfeeding should be continued for at least the first year of life and beyond for as long as mutually desired by mother and child.”¹ Bartick and Reinhold report that the United States could save \$13 billion per year and prevent in excess of 911 deaths annually, “If 90% of US families could comply with medical recommendations to breastfeed exclusively for 6 months.”²

Women with diabetes can successfully breastfeed with proper education, planning, and support. Studies involving lactating women with diabetes demonstrate that success is strongly associated with educational level as well as the level of support they receive from significant others.^{3,4} Support may come from many sources: spouse, family, friends, health professionals, employers, community organizations and support groups.² Health professionals working with this population are in an excellent position to encourage breastfeeding and provide the education and support a woman needs to breastfeed. Multiple studies have shown that encouragement by health professionals increased breastfeeding initiation⁵ and duration.⁶ One large national study found that women were four times more likely to initiate breastfeeding when they received encouragement from their providers.⁵ Such studies support using CDAPP Sweet Success practitioners to promote breastfeeding. A study of women with type 1 diabetes who breastfed for greater than four months found success rates comparable to the non-diabetic population.⁴ Initiation and continued breastfeeding for at least 4 months among women with DM1 was comparable to the background population. Breastfeeding discontinuance is often not related to diabetes but is more frequently due to the mother being unsure if she is providing enough breastmilk.⁴

GENERAL BREASTFEEDING EDUCATION GUIDELINES

Breastfeeding education is similar for women with and without diabetes. Both benefit from an approach that encourages and supports breastfeeding as the normal way to feed babies and is consistent with the culture and beliefs of the woman, her family, and her support system. A woman's concerns about breastfeeding should be elicited and responded to. She should be referred to a lactation specialist, such as an International Board Certified Lactation Consultant (IBCLC), if necessary. Previous breastfeeding experience, social isolation, and

beliefs about breastfeeding also influence a woman's decision to breastfeed. Education which addresses typical misconceptions about breastfeeding allows a woman to make an informed decision. Breastfeeding education should be offered in small doses, such as during preconception and regular prenatal visits.

**SUPPORTIVE
POLICIES FOR
BREASTFEEDING**

The basics of breastfeeding education include, but are not limited to, the topics listed in Table 1. Resources for breastfeeding support are listed in Table 2.

Table 1. BASIC BREASTFEEDING EDUCATION
<ul style="list-style-type: none"> ❖ Breast changes that occur during pregnancy ❖ Family support for breastfeeding ❖ Birth practices that support breastfeeding ❖ Skin to skin, rooming in, feeding cues, normal feeding frequency, and infant skills ❖ Comfortable positioning and latching-on technique ❖ Breastfeeding as a learned art that requires practice ❖ Breast changes that occur during pregnancy and lactation ❖ Addressing maternal concerns regarding breast size, diet, socioeconomic issues, previous experience, and misinformation given by other sources ❖ Strategies to deal with common concerns regarding milk supply, quality, and quantity ❖ Information and links to resources to help the mother deal with problems such as inverted, cracked, or sore nipples; fatigue, and signs and symptoms of breast infection ❖ Community resources for handling questions about breastfeeding ❖ Ways to evaluate whether the baby is getting adequate milk ❖ Ways to increase milk supply and assure an adequate sustained supply ❖ Ways to deal with negative social attitudes about breastfeeding in public ❖ Resources to help women continue breastfeeding after returning to work

Table 2. RESOURCES FOR BREASTFEEDING SUPPORT
<ul style="list-style-type: none"> ❖ La Leche League International http://www.llli.org/ ❖ Women, Infants, and Children (WIC) program http://www.cdph.ca.gov/PROGRAMS/WICWORKS/Pages/default.aspx http://www.fns.usda.gov/wic/Breastfeeding/mainpage.HTM ❖ International Lactation Consultants Association http://www.ilca.org/i4a/pages/index.cfm?pageid=1 ❖ Comprehensive Perinatal Services Program, Steps to Take Handbook http://www.cce.csus.edu/portal/admin/handouts/CPSP-StepsToTake-Fall2014.pdf ❖ California Department of Public Health http://www.cdph.ca.gov/programs/BreastFeeding/Pages/default.aspx

The following suggestions for hospital policies, listed in Table 3, are adapted from 2005 Providing Breastfeeding Support: Model Hospital Policy Recommendations.⁷ This document was endorsed by the California Department of Public Health (CDPH) and recommended to all birthing hospitals in California.

A web-based toolkit to implement these policies is available through the CDPH website:

- ✓ <http://www.cdph.ca.gov/programs/breastfeeding/Documents/MO-05ModelHospitalPolicyRecommend.pdf>

Table 3. SUMMARY OF 2005 MODEL HOSPITAL POLICY RECOMMENDATIONS⁷

<p>PURPOSE: These policy recommendations are designed to give basic information and guidance to perinatal professionals who wish to revise policies that affect the breastfeeding mother.</p> <p>Policy #1: Hospitals should promote and support breastfeeding.</p> <p>Policy #2: Nurses, certified nurse midwives, physicians and other health professionals with expertise regarding the benefits and management of breastfeeding should educate pregnant and postpartum women when the opportunity for education exists, for example, during prenatal classes, in clinical settings, and at discharge.</p> <p>Policy #3: The hospital will encourage medical staff to perform a breast exam on all pregnant women and provide anticipatory guidance for conditions that could affect breastfeeding. Breastfeeding mothers will have an assessment of the breast prior to discharge and will receive anticipatory guidance regarding conditions that might affect breastfeeding.</p> <p>Policy #4: Hospital perinatal staff should support the mother’s choice to breastfeed and encourage exclusive breastfeeding for the first 6 months.</p> <p>Policy #5: Nurses, certified nurse midwives, and physicians should encourage new mothers to hold their newborns skin to skin during the first two hours following birth and as much as possible thereafter, unless contraindicated.</p> <p>Policy #6: Mothers and infants should be assessed for effective breastfeeding. Mothers should be offered instruction in breastfeeding as indicated.</p> <p>Policy #7: Artificial nipples and pacifiers should be discouraged for healthy, breastfeeding infants.</p> <p>Policy #8: Sterile water, glucose water, and artificial milk should not be given to a breastfeeding infant without the mother’s informed consent and/or physician’s specific order.</p> <p>Policy #9: Mothers and infants should be encouraged to remain together during the hospital stay.</p> <p>Policy #10: At discharge, mothers should be given information regarding community resources for breastfeeding support.</p>

**BREASTFEEDING
GUIDELINES FOR
WOMEN WITH
DIABETES**

Breastfeeding guidelines for the general population also apply to women with diabetes. The following categories have been designed by the American Association for Diabetes Educators (AADE 7 Self-Care Behaviors™) to serve as a framework for addressing the special needs of people with diabetes.⁸ We will address the special needs of women with diabetes who choose to breastfeed within these categories⁸:

- ❖ Reducing Risks
- ❖ Healthy Eating
- ❖ Self-monitoring of Blood Glucose
- ❖ Taking Medications
- ❖ Healthy Coping
- ❖ Staying Active
- ❖ Problem-solving

REDUCING RISKS

Benefits of Breastfeeding with Regard to Diabetes

A systematic review by Taylor et al concluded that: “Women with diabetes should be strongly encouraged to breastfeed because of maternal and childhood benefits specific to diabetes that are above and beyond other known benefits of breastfeeding.”⁹

Breastfeeding confers unique immunologic, growth, and developmental benefits for women and infants. Breastfeeding optimizes weight control in infancy through adolescence and may reduce or delay the onset of diabetes.¹⁰ Research suggests that this protection extends into adulthood. For women with diabetes, breastfeeding benefits include: reduced risk of cardiovascular disease, and metabolic disease such as DM.^{11,12} Many women also find their diabetes more easily managed after the birth of the baby when they breastfeed.¹³

Risks of not breastfeeding for infants and mothers are summarized in Table 4.

Table 4. RISKS OF NOT BREASTFEEDING FOR INFANTS AND MOTHERS¹⁴	
Infant	Mother
<ul style="list-style-type: none"> ❖ Diarrhea and gastroenteritis ❖ Necrotizing enterocolitis in preterm infants ❖ Sudden Infant Death Syndrome (SIDS) ❖ Asthma, pneumonia, ear infections ❖ Childhood obesity and type 2 diabetes 	<ul style="list-style-type: none"> ❖ Retention of gestational weight gain ❖ Postpartum depression ❖ Type 2 diabetes ❖ Metabolic syndrome ❖ Premenopausal breast cancer ❖ Ovarian cancer

Breastfeeding may also reduce the risk for conditions later in life.¹⁵ Studies show that in childhood, there is a reduced risk of asthma and atopic dermatitis in those with a positive family history. Breastfeeding is associated with reduced risk of obesity in later life. Among parous women with no history of gestational diabetes, the risk of developing type 2 diabetes is reduced.¹⁶

Type 1 Diabetes and Breastfeeding Benefits

Research has shown an association between breastfeeding and reduction of the risk of type 1 diabetes in susceptible children.^{17,18} Recent research appears to support the role of exclusive breastfeeding in at least delaying the onset of type 1 diabetes in susceptible children.¹⁹ Research is continuing with the Finnish Trial to Reduce IDDM in the Genetically at Risk Study.²⁰

Studies with type 1 diabetes and breastfeeding have been controversial. Most studies demonstrate a benefit for the offspring when compared to bovine or casein protein containing formulas.^{17,18} There are some studies with contradictory findings in regard to the benefits of breastfeeding in relation to offspring obesity.^{21,22} Overall, breastfeeding appears to be a significant component in the reduction of risk for the offspring of a woman with type 1 diabetes.

Type 2 Diabetes/GDM and Breastfeeding Benefits

Studies have shown that infants of mothers with type 2 diabetes or GDM have increased rates of prematurity as well as neonatal complications. These risk factors increase the risk of separation and delayed breastfeeding initiation compared to infants of women without diabetes.⁹ Obese women were even less likely to breastfeed, possibly due to more complicated pregnancy, labor, and birth, as well as difficulty with body mechanics involved.⁹ The benefits of breastfeeding to both the woman and her infant are significant and require strong support and encouragement for these mothers to attempt breastfeeding.

Two small studies assessed the influence of lactation on glucose tolerance in women without diabetes. The first study in lactating women showed that all had higher prolactin levels and significantly lower levels of estradiol ($p < 0.0005$) as well as lower fasting glucose and insulin levels ($p = 0.05$). This study concluded that low levels of estradiol associated with breastfeeding may improve glucose tolerance.⁹ In the second study by McManus et al, improved β cell function with 3 months of breastfeeding in women with a history of GDM was demonstrated. However, no significant differences in glucose tolerance were noted.²³

In a study of women who had experienced GDM, breastfeeding improved lipid and glucose metabolism during the postpartum period when compared to women who had GDM and did not breastfeed.¹³ That same study showed postpartum glucose values were significantly lower in the breastfeeding group ($p < 0.01$). Non-lactating women developed type 2 diabetes at a 2-fold higher rate than lactating women (9.4% vs. 4.2%, $p = 0.01$). These results persisted when controlling for BMI, age, and insulin use in pregnancy.¹³

Stuebe et al found that “duration of lactation was inversely associated with risk of type 2 diabetes in young and middle aged women, independent of other diabetes risk factors, including body mass index, diet, exercise, and smoking status.¹² This association seemed to lessen with time starting from when they delivered their last child.¹²

Breastfeeding Benefits for the Offspring

Infants of women with mild to severe glucose intolerance are at risk for infant and childhood obesity.¹⁰ According to Kerssen et al, “breast-fed infants are leaner than formula-fed infants.”²⁴

Breastfeeding is associated with reduced risk of type 2 diabetes later in life. Specifically, breastfeeding may set lower satiety thresholds; reduce insulin levels during infancy; and reduce exposure to chemicals and nitrates, which impair pancreatic beta-cell function. A relationship has also been shown between breastfeeding and reduction of type 2 diabetes in Pima Indian children.^{25,26} Although WHO and AHRQ identified studies that found breastfed infants were less likely to develop type 2 diabetes, some studies showed no association. It is not possible to draw conclusions on the long-term effects of breastfeeding on the risk of type 2 diabetes.²⁷

Research has shown a protective effect of exclusive breastfeeding against some cardiovascular risk factors in adult life.²⁸

The Risk of Bottle-Feeding

There is a potential relationship between prolonged or frequent bottle-feeding and excess weight, which may contribute to diabetes. One recent study found that excess weight at late infancy was associated with frequency of infant-initiated bottle emptying during early infancy, regardless of the bottle’s contents. Possible reasons include poor appetite control due to ease of sucking a bottle and lack of physiologic signaling which is available through breastfeeding.²⁹ Another study found that delayed bottle-weaning corresponded to an increased risk of overweight in children aged 3-5 years.³⁰

Bottle and formula use are modifiable factors that may prevent excess weight gain and thus disease risk for the child.

Avoiding Newborn Hypoglycemia with Early Breastfeeding

Maintaining maternal normoglycemia during pregnancy and in particular during labor and delivery is the best way to avoid neonatal hypoglycemia.³¹ Betamimetic drugs such as Ephedrine (often used to treat acute hypotension associated with epidural or spinal anesthesia) or Terbutaline (used to acutely reduce uterine activity in the presence of fetal distress) given just before birth can cause maternal hyperglycemia and aggravate the risk for hypoglycemia in the newborn.³²

Early (preferably in the first hour of life) and often (10 -12 times per 24 hours) breastfeeding can reduce the risk of hypoglycemia. Newborns that are wet and cold utilize glucose to generate warmth, therefore it is imperative to dry the newborn thoroughly and place him/her skin to skin with his/her mother as he/she feeds. Women who undergo cesarean birth should not be an exception. It is possible for an otherwise healthy newborn to begin breastfeeding in the operating room or in the recovery room. Every effort should be made to provide care (physical assessment and glucose monitoring) needed by this couplet without separating them. Early separation of the mother baby couplet may delay lactogenesis³³ as well as increase the likelihood the baby will be supplemented with formula.³⁴

Refer to Table 5 for more information on interventions to prevent hypoglycemia in the newborn.

Table 5. IMMEDIATE INTERVENTIONS TO AVOID HYPOGLYCEMIA IN THE NEWBORN³⁵

- ❖ Reduce glucose utilization - thoroughly dry and place newborn skin to skin with mother covering both with dry, warm blankets. Cover newborn's head with dry warm cap.
- ❖ Breastfeed early and often - immediately to within the first 30 to 60 minutes after birth.
- ❖ Check first newborn blood glucose before and after first feeding then check before subsequent feedings until stable within accepted levels.
- ❖ Avoid scheduling breastfeeding - encourage frequent feeding until the blood glucose is stable.
- ❖ Observe newborn for symptoms hypoglycemia (jitteriness or tachypnea) and check blood glucose if noted.
- ❖ Abnormal glucose values need to be followed by rechecking blood glucose levels after interventions - refer to *Chapter 5: Impact of Maternal Diabetes on Fetal Development and Neonatal Care* for interventions.

The couplet experiencing medically necessary separation will need extra support to establish breastfeeding. The mother should be instructed in breast pump use within the first 12 hours after giving birth; the earlier the better to ensure adequate milk supply. The pumped colostrum or

milk may be fed to the newborn by methods other than bottle and artificial nipple (such as a spoon, cup, eyedropper or feeding syringe) to prevent potential nipple confusion. The information the mother was given prenatally on the importance of frequent breast milk feeding without supplementation should be reinforced and mother’s intent to exclusively breastfeed should be honored unless medical necessity exists to use supplemental feedings. A diabetes educator familiar with the woman’s daily challenges, lactation specialist and knowledgeable nursery and postpartum staff need to be available to support the mother and baby with special needs.

Educate mother on infant feeding cues, cluster feeding, and need for flexibility in the early days of breastfeeding. Examples of infant feeding cues are turning of the head; bringing hands to the face; rooting; making licking, smacking or sucking movements; or sucking hands or blanket. Note that crying is a late sign of hunger and can make breastfeeding more difficult. It is normal for infants to want to cluster feed, which is to feed more frequently at certain times of the day. If kept skin-to-skin and allowed free access to the breast, infants will nurse at frequent intervals for short periods of time throughout the day.³⁶⁻³⁸ Attempts to force routine or scheduled feedings will frustrate both mother and infant and lead to the mother’s misunderstanding of her infant’s behavior and feeding cues. For more information on baby behaviors, visit:

- ✓ <http://www.secretsofbabybehavior.com/2009/06/baby-behavior-basics-part-2-many-moods.html>
- ✓ <http://www.secretsofbabybehavior.com/2009/06/baby-behavior-basics-part-3-learning.html>
- ✓ <https://www.cdph.ca.gov/programs/wicworks/Pages/WICCaliforniaBabyBehaviorCampaign.aspx>

Promote early feeding at the breast by one hour of age. Encourage frequent feeding until infant blood glucose is stable (≥ 45 mg/dL before feeding).³² Monitor infant blood glucose for at least 24 hours or until stable for at least three consecutive feedings.

MATERNAL SELF
MONITORING OF
BLOOD GLUCOSE
WITH
BREASTFEEDING

Table 6. BLOOD GLUCOSE TARGETS FOR BREASTFEEDING	
Fasting/Premeal:	70 - 100 mg/dL
1 - 2 hrs postmeal:	< 150 - 155 mg/dL

The breast milk of women with controlled diabetes was similar to that of women without diabetes with respect to carbohydrate and lipid content at the above blood glucose values.^{39,40} Recent studies that did not control for glycemic control suggest that the breast milk of women with DM with uncontrolled blood glucose levels may actually contribute to adverse outcomes for the offspring such as reduced glucose tolerance and increased body weight.²¹ Therefore, CDAPP Sweet Success Guidelines recommend tight control of blood glucose during lactation for optimal results.

Women with type 1 diabetes are encouraged to monitor fasting, pre-meal, 1 hour post meal, bedtime and 3 am blood glucose levels. Additionally, checking blood glucose levels just before and 1 hour after breastfeeding began is advised for the first 3 days postpartum. If blood glucose is less than 100 mg/dL prior to breastfeeding, a 15 gram carbohydrate snack is advised to prevent hypoglycemia.

Lactating women with type 2 diabetes should monitor blood glucose fasting, 1 hour post meals, bedtime and occasionally at 2-3 AM.

Type 1 Diabetes

A lactating woman with type 1 diabetes may experience erratic patterns of glucose control including hypoglycemia. Episodes of hypoglycemia induce the release of epinephrine, which can cause a temporary decrease in milk production. Because hypoglycemia is most likely to occur within an hour after breastfeeding, this is an important time to measure blood glucose. In most cases, hypoglycemia can be avoided by eating a snack containing carbohydrate (about 15 grams) and protein before or during breastfeeding rather than making frequent adjustments in the insulin dosage.⁴¹ Nocturnal hypoglycemia is common. This makes periodic blood glucose monitoring during the night vital. If hypoglycemia is documented, the evening dose of basal insulin can be decreased or a woman can eat a high-protein snack before bed.

Tight glucose control is recommended early in lactogenesis and throughout the breastfeeding experience.

Type 2 Diabetes

Women with type 2 diabetes are advised to monitor blood glucose control with blood glucose checks at least fasting and post meals (as above) to ensure target control is achieved.

TAKING
MEDICATIONS
DURING
LACTATION

Medications prescribed to breastfeeding mothers can be researched for their safety by using resources such as *Medications and Mothers' Milk* by Thomas W. Hale.⁴² All medications need be evaluated before being prescribed to a breastfeeding mother.

Insulin

Because glycemic control increases the chances of a successful lactation experience, flexibility, effort and support are required to achieve normoglycemia and increase a woman's chances of achieving her goal for breastfeeding. Insulin adjustments must be made based on results of blood glucose monitoring. These adjustments are based on changes in kilocalorie intake, the infant's feeding routine and other schedule adjustments. Frequent self-monitoring of blood glucose, as described above, allows more optimal adjustment of insulin to meet these changes. One of the most important issues in adjusting insulin during lactation is to address the nighttime basal insulin dose. Nocturnal hypoglycemia occurs when kilocalories and glucose are shunted for milk production for the nighttime feeding. Many women with DM1 need to significantly lower their night dose of basal insulin during the lactation period.³¹ Counseling includes the importance of checking the blood glucose at 2-3 a.m. with appropriate adjustment to avoid nocturnal hypoglycemia. In contrast, insulin needs during the day may stay the same or even increase if a woman eats more kilocalories to maintain milk production. Infant growth spurts may cause increased infant energy requirements and create a need for additional adjustments in the meal plan and insulin regimen to maintain normoglycemia. As the baby gets older and solids are introduced, the demand for breast milk will begin to decrease and insulin needs will again require adjustment based on the mother's blood glucose values.

Oral Agents

The major concern for a woman with type 2 diabetes is the use of oral hypoglycemic agents in controlling the blood glucose and their effects on breast milk. It is recommended that a woman with type 2 diabetes who is unable to maintain normoglycemia through exercise and diet alone continue with insulin during the lactation period.⁴³ However, oral hypoglycemic agents can be used in lactating women. The American Academy of Pediatrics has judged tolbutamide, a first generation sulfonylurea, safe to be used by a lactating woman with type 2 diabetes.⁴⁴ Even though small amounts of tolbutamide cross into breast milk, it has been in use for a number of years and, to date, there are no adverse reports in the literature. Studies have shown that metformin also permeates into breast milk in low concentrations. When the blood glucose of nursing infants whose mothers took metformin were calculated, no negative effects were found.^{45,46} According to a small study published in 2005, neither glyburide nor glipizide were detected in the breast milk, and hypoglycemia was not observed in three nursing

infants. Feig et al concluded that “Both drugs appeared to be compatible with breastfeeding.”⁴⁴

There are many other oral hypoglycemic agents on the market. There are almost no data on their ability to cross into human milk and most have not been reviewed by the American Academy of Pediatrics or the American Diabetes Association.

Refer to Table 7 for a list of oral hypoglycemic (OHA) agents and their lactation risk categories. A lower number is associated with a lower risk.

Table 7. ORAL HYPOGLYCEMIC AGENTS’ LACTATION RISK* CATEGORY⁴²	
Oral Hypoglycemic Agent	Lactation Risk Category
Tolbutamide	L3
Metformin	L1
Acarbose	L3
Glyburide	L2
Glipizide	L3
Repaglinide	L4
Diabinese	L3
Thiazolidinediones	No Studies

* Lactation risk is being defined as the possible risks to an infant associated with medications taken by a breastfeeding mother. Refer to *Appendix A* for definitions of each Lactation Risk Category. Table/Information used with permission from Hale Publishing.

Other Medications

In addition to insulin or glucose lowering (oral hypoglycemics), women with diabetes often take other medication such as lipid or blood pressure lowering pills. Refer to table 8 below:

Table 8. OTHER MEDICATIONS’ RISKS DURING LACTATION³	
Medication	Recommendation
Ace inhibitors	Not recommended in first two weeks of life
ARBs	Not studied
Beta blockers	Recommendation varies depending on the specific drug
Calcium Channel Blockers	Approved by AAP
Methyldopa	Approved by AAP
Statins: HMG CoA Reductase Inhibitors	Not recommended during lactation

Breastfeeding and Psychiatric Medication

Benefits of breastfeeding are well established, but using certain medication while lactating complicates the decision to breastfeed for mothers and professionals who care for them. Given the prevalence of psychiatric illness during the perinatal period, a significant number of women may be using psychotropic medication while breastfeeding. Best practice is always an individualized risk-benefit analysis of the severity of the mother's depression and potential known risks to the infant.⁴⁷

No professional medical association has issued formal guidelines regarding pregnant or lactating women and use of psychiatric medication treatment including SSRIs.⁴⁸ Current research does indicate that, while all medications are secreted into the breast milk, the incidence of adverse effects on nursing infants appears to be relatively low.⁴⁹ Data indicates that all psychotropic medications, including antidepressants, lithium, anti-psychotics, anticonvulsants, and benzodiazepines, are secreted into breast milk although concentrations vary significantly. Long-term neurodevelopmental effects for the infant may not be predictable but maternal-children relational difficulties in untreated depression are well documented.⁴⁷

Table 9. SOME PSYCHIATRIC MEDICATIONS' LACTATION RISK* CATEGORY⁴²	
Medication	Lactation Risk Category
Antidepressants	
Sertraline, Fluoxetine, Citalopram	L2
Mood Stabilizers	
Carbamazepine, Valproic Acid	L2
Lithium	L3
Anxiolytics	
Valium, Clonazepam, Lorazepam	L3
Antipsychotics	
Quetiapine (Seroquel)	L2
Risperidone (Risperdal)	L3
Aripipazole (Abilify)	L3
Ziprasidone (Geodon)	L4
* Lactation risk is being defined as the possible risks to an infant associated with medications taken by a breastfeeding mother. Refer to <i>Appendix A</i> for definitions of each Lactation Risk Category. Table/Information used with permission from Hale Publishing.	

Antidepressants

In recent years, more information has been compiled on the use of antidepressants in nursing women. Data on tricyclic antidepressants and sertraline and fluoxetine has been encouraging, suggesting that the infant's exposure to amounts of the drug is low and that neonatal complications appear rare.⁵⁰ Most often serum levels of the drug in

the nursing infant are very low or undetectable and one report indicates that exposure to SSRIs during nursing does not result in significant blockage of serotonin reuptake in infants.⁵¹

SSRIs are preferred by many when treating depression, but more safety data on breastfeeding is ultimately needed.⁵¹

Sertraline has shown low transmission via umbilical cord to maternal serum ratios in small samples and has reassuring breastfeeding data.⁵²

- ❖ Fluoxetine has been the most studied SSRI in pregnancy, but it has a long half-life and is not recommended in breastfeeding as it may accumulate in infant sera.⁵²
- ❖ Citalopram (and escitalopram) data supports its safe usage in breastfeeding women.⁵³

Mood Stabilizers

Bipolar disorder poses more significant difficulties to breastfeeding women. On demand breastfeeding disrupts a mother's sleep that can increase the possibility of relapse. Toxicity has been reported with mood stabilizers, including lithium, carbamazepine and valproic acid.^{54,55} AAP determined carbamazepine and valproic acid are appropriate for breastfeeding women.⁵⁶ Lithium is included in the drugs that have been associated with significant effects on some nursing infants and should be given to nursing mothers with caution.⁵⁶

Anxiolytics

Data on benzodiazepines, diazepam (Valium), clonazepam (Klonopin), lorazepam (Ativan) is limited⁵⁷ with some adverse effects noted.

Antipsychotics

Information about use of antipsychotic drugs is limited, especially for newer atypical antipsychotics such as risperidone (Risperdal), quetiapine (Seroquel), ziprasidone (Geodon), and aripiprazole (Abilify).⁵⁸ Data on clozapine suggests it is concentrated in breast milk.⁵⁹

Treatment Guidelines

As studies and clinical experience with breastfeeding mothers and concomitant drug use increase, reassuring results for the mothers and professionals will help in the decision-making process. As with any informed critical decision, up-to-date information is needed by the health professional to assist the mother in making the best decision for

herself and her family. Careful coordination with the prescribing psychiatrist and pediatrician is essential.

PROBLEM SOLVING
WHILE
BREASTFEEDING

In general, a woman with diabetes is more susceptible to infection of all kinds. For example, a yeast infection may occur on the nipples and breast tissue of a nursing mother and in the mouth of the baby. Treatment must be provided to both mother and baby at the same time, or it will be ineffective. Good hand washing, nipple care and glycemic control can help reduce the incidence of yeast infections.

Mastitis

A woman should be counseled to recognize the signs and symptoms of mastitis, which can first present as achiness and flu-like symptoms. Yeast infections are common. The health care provider must be contacted immediately to initiate treatment as early as possible. Prolonged treatment will avoid reoccurrence. It is important to rule out infection when there are unexplained blood glucose elevations, as infections are known to raise blood glucose levels.

Contraception

The health care provider should address contraception needs. Breastfeeding may be contraceptive for some women in the first six months if the infant is exclusively breastfed (including at night) without artificial pacifiers, soothers or bottles and if the mother has not resumed menstruation. However, breastfeeding is not considered to be an effective contraceptive method. Therefore, additional contraceptive methods are recommended if the mother wishes to delay a subsequent pregnancy. Contraception during and after lactation should be addressed to prevent unplanned pregnancies. Women with a history of GDM need to be mindful of the type of birth control utilized during breastfeeding. Some progesterone only birth control methods (i.e. Depo-Provera, minipill, Norplant) should not be the first choice for contraception when breastfeeding^{60,61} because they are associated with increased diabetes rates.

Further information on contraception for women with diabetes can be found in *Chapter 2: Preconception and Interconception Care for Preexisting Diabetes*.

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Appendix A

Dr. Hales Lactation Risk Category

Dr. Hales Lactation Risk Category ⁴²	
Category	Description
L1 SAFEST	Drug which has been taken by a large number of breastfeeding mothers without any observed increase in adverse effects in the infant. Controlled studies in breastfeeding women fail to demonstrate a risk to the infant and the possibility of harm to the breastfeeding infant is remote; or the product is not orally bio-available in an infant.
L2 SAFER	Drug which has been studied in a limited number of breastfeeding women without an increase in adverse effects in the infant. And/or, the evidence of a demonstrated risk which is likely to follow use of this medication in a breastfeeding woman is remote.
L3 MODERATELY SAFE	There are no controlled studies in breastfeeding women, however the risk of untoward effects to a breastfed infant is possible; or, controlled studies show only minimal non-threatening adverse effects. Drugs should be given only if the potential benefit justifies the potential risk to the infant.
L4 POSSIBLY HAZARDOUS	There is positive evidence of risk to a breastfed infant or to breast milk production, but the benefits of use in breastfeeding mothers may be acceptable despite the risk to the infant (e.g. if the drug is needed in a life-threatening situation or for a serious disease for which safer drugs cannot be used or are ineffective).
L5 CONTRAINDICATED	Studies in breastfeeding mothers have demonstrated that there is significant and documented risk to the infant based on human experience, or it is a medication that has a high risk of causing significant damage to an infant. The risk of using the drug in breastfeeding women clearly outweighs any possible benefit from breastfeeding. The drug is contraindicated in women who are breastfeeding an infant.

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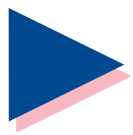
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CDAPP Sweet Success Guidelines for Care

Chapter 9

Behavioral and Psychosocial Components of Care



*Sweet
Success.*

California Diabetes and Pregnancy Program

California Diabetes and Pregnancy Program Sweet Success Guidelines for Care

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Behavioral and Psychosocial Components of Care

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9 Behavioral and Psychosocial Components of Care

INTRODUCTION

This section addresses the importance of behavioral and psychosocial components and provides suggestions for effective interventions in assisting pregnant women. While pregnancy is often thought of as being an emotionally fulfilling time and therefore protects against any potential psychiatric issues, research has actually proven this is often not the case.¹ Pregnancy presents a critical time in women's lives with its own challenges to mothers and their families. The quality of a mother's attachment to her child critically affects neurodevelopment of her infant's brain and has far reaching consequences for all aspects of the child's emotional, social and cognitive development and the woman's ability to care for herself.²

CHANGES IN PSYCHOSOCIAL CARE OF PREGNANT WOMEN WITH DIABETES

There has been a major shift in the psychosocial research related to diabetes care which challenges long held beliefs and training about the nature of relationships between providers and patients. How comfortable are providers following the patient's lead, noting her readiness for change, and guiding her through the rigorous regime of diabetes care? Can providers make the shift from "being the expert" to "having expertise" about diabetes and truly seeing the pregnant mother as a collaborator in care?

PATIENT EMPOWERMENT

Current literature supports the patient empowerment philosophy of diabetes care. The empowerment approach conflicts with the more traditional method of care that is compliance-oriented.^{3,4} This paradigm shift to a philosophy of patient empowerment recognizes the woman as a co-provider of her care.⁴ As such, she reshapes her lifestyle within her family system and home.

Beyond focusing on psychosocial risk factors, current research addresses the impact of a woman's:

- ❖ Pregnancy concerns
- ❖ Attachment behaviors
- ❖ Therapeutic relationship with providers
- ❖ Guiding techniques for motivation
- ❖ Degree of emotional well-being and how that contributes to effective diabetes care during pregnancy

To support women in their self-care for their diabetes, pregnancies, and ultimately themselves, providers must recognize that a major part of patient care occurs in the patients' home, not in a hospital or clinic setting. Providers need to establish relationships with patients that encourage empowerment, self-efficacy, and a readiness to embark on what is often an incredibly complex regime affecting all areas of their lives.⁵⁻⁷ Providers should offer effective interventions which include behavioral and psychosocial components.

Pregnancy generates biological, psychosocial, and financial demands on a woman and her support network. Medical complications in pregnancy, such as diabetes, magnify these demands, increase psychosocial risks, and place increased adjustment and adaptation demands on a woman, her inner resources and external support system.⁶ For some women, this will result in symptoms of anxiety and depression which may not be readily apparent, but need to be addressed.

PROFESSIONAL PSYCHOSOCIAL SERVICES

Professional psychosocial services are an essential component of the care provided by CDAPP Sweet Success diabetes care providers.⁸ These services are directed toward engaging the woman in understanding and managing the biological, emotional, and social stressors of a pregnancy complicated by diabetes. The Behavior Medicine Specialist (BMS) is an integral part of the diabetes care team whose goal is to enhance a woman's ability to manage her diabetes, make necessary lifestyle changes, and care for the well-being of herself and her child.

SELF-EFFICACY AND PATIENT PROVIDER RELATIONSHIP

In actuality, the mother is her own health care provider. Among her other pressing responsibilities is learning about and treating her diabetes daily in her own home and reshaping her lifestyle. Because diabetes care has to be integrated with other social, cultural, psychological, and demographic priorities of a woman's life, blood glucose control is only one element of self-care. This presents a major challenge for providers trained in an acute care model stressing patient's compliance with the treatment plan.

Providers do not have control at all over what happens when the woman leaves the brief clinic session. In fact, caring for diabetes is better suited for a chronic care model which stresses the importance of partnerships between patients, families, community, and providers in ensuring a successful outcome.

Virtually every mother wants a healthy baby, as do all in her family and circle of support. By empowering the patient to be central in her care, education and guidance can enhance her ability to make informed

choices about her and her baby's health and diabetes. Within the context of the woman's life, the provider will coordinate with her on:

- ❖ The clinical management of diabetes
- ❖ Skills for behavior change
- ❖ Communicating with the health care team so that her concerns are understood
- ❖ Continuing reassessment of realistic treatment goals

READINESS FOR CHANGE: MOTIVATIONAL INTERVIEWING

Providers often assume that a woman is ready to begin a treatment regime when she arrives for her first appointment. Certainly the team is ready, but assessing a patient's readiness for change is the first step before determining how to motivate and guide her through essential segments of successful treatment.⁹ Remember, the woman may have difficulty articulating and resolving her ambivalence about diabetes treatment.

Motivational interviewing (MI) uses both directive and non-directive solution-focused counseling styles to encourage behavioral changes that help patients analyze and overcome any hesitancy to treatment.¹⁰ Once the provider learns to use MI, they establish a partnership between provider and patient which is more effective than traditional advice giving, without consuming more time.¹¹ MI is especially effective with the management of diseases such as diabetes, which requires major lifestyle changes. MI helps resolve differences between the expressed treatment goals and actual management, and helps to strengthen the provider-patient relationship. This assists providers to work with the mother in designing intervention strategies and setting up a working plan. The MI approach offers providers with tools to manage the diabetes, sharing the responsibility, and avoiding the provider's perception, "the patient's not compliant" to "I wonder what she needs or how she understands this?" When a woman is asked questions that imply her concerns, feelings and even disagreements with us as providers are respected and listened to; a collaborative relationship is being built which sustains the rigors of the treatment regime ahead.⁹⁻¹¹

"STAGES OF CHANGE" MODEL

The "Stages of Change" model crafted by Prochaska, DiClemente and Norcross shows that change occurs gradually and often advances in a non-linear spiral progression.¹² Our perception of resistance to treatment recommendations may simply reflect a patient being at an earlier stage of change and not yet ready to actively participate in her own care. With skills in applying stages of change, providers do not get stopped at the barrier caused by belief that the patient is "noncompliant," but instead, begin asking questions that expand rather than constrict their understanding.

There are 5 stages in this model, however, Prochaska et al note that individuals may experience a relapse in their behaviors. He refers to this natural progression of change as “Relapse or recycling.”¹² For simplicity, we are briefly listing these stages with examples of patient behavior and provider questions. These “Stages of Change” are adapted with permission from the American Psychological Association¹²:

Pre-Contemplation

- ❖ Patient behavior: Patient denies or does not recognize that there is a problem and is reluctant to discuss the problem. Patient may not follow up on treatment recommendations.
- ❖ Provider questions/responses: What does having diabetes mean to you? What warning signs would let you know there was a problem? What have you already heard?

Contemplation

- ❖ Patient behavior: Patient is ambivalent, but discusses the problem and weighs the pros and cons of initiating change.
- ❖ Provider questions/responses: What makes it hard for you to change at this time? What might help you with this? How would you like me to assist in caring for you and your baby?

Preparation

- ❖ Patient behavior: Patient understands that change is needed and begins to commit to goals.
- ❖ Provider questions/responses: What is realistic for you to do today? This week? How can I support you in reaching this goal?

Action

- ❖ Patient behavior: Patient is taking steps to change behavior and implement that change into her lifestyle.
- ❖ Provider questions/responses: You made so many changes for you and your baby. What did you do to make that happen? What else would help you?

Maintenance

- ❖ Patient behavior: Patient perseveres and sustains new behaviors with less effort. Patient is aware of high risk situations.
- ❖ Provider questions/responses: You have consistently done so well. What have you learned are your high risk areas?

Lapse/Relapse (Stage of Change added by CDAPP Sweet Success)

- ❖ Patient behavior: Patient’s personal distress or events interrupt change with a resulting temporary loss of progress.
- ❖ Provider questions/responses: Change takes time; this is expected. What can you learn from this to help you in the future?

Within these questions are the themes of accentuating strengths and self-efficacy, providing support, and openly discussing obstacles to change. With the addition of Lapse/Relapse, consider change as a six step process where patients may move forward or back in relation to life events, stress and resources.

ASKING OPEN-ENDED QUESTIONS

Skill in using open-ended questions strengthens a woman's self-efficacy and offers providers tools to be more successful when meeting obstacles during treatment. Below are a few examples of effective open-ended questions that also reinforce a collaborative relationship:

❖ **QUESTIONS THAT CLARIFY:**

- Does this make sense to you?
- Did I explain it well?
- What seems to not be clear?
- Can you explain what you mean by that?

❖ **QUESTIONS THAT IDENTIFY ISSUES:**

- What seems not to be working?
- What do we need to change?
- What is the toughest part of this for you?
- I do not think this is working. What do you think we need to do?

❖ **QUESTIONS THAT ENCOURAGE PLANNING:**

- What do you see as the first thing to do?
- What do you need from me to help with this?
- What are your next steps?

❖ **QUESTIONS THAT LOOK AT THE TOTAL PICTURE:**

- What have you tried so far?
- When does that usually happen?
- What do you make of this change?

PSYCHOSOCIAL ASSESSMENT

Psychosocial screening should be strongly encouraged for all women throughout their pregnancy, as recommended by American Diabetes Association and American College of Obstetricians and Gynecologists.^{13,14}

Beyond initial screening, additional monitoring is recommended when:

- ❖ A mother's participation in care diminishes
- ❖ She has increased life stressors
- ❖ She exhibits distressed interactions with providers

In addition, the providers should assess the clients for domestic/intimate partner violence which is the most common cause of injury to women in the United States. For more information:

- ❖ www.safehorizon.org
- ❖ www.nlm.nih.gov/medlineplus/domesticviolence.html
- ❖ Domestic Violence Helpline: 800-978-3600
http://www.lapdonline.org/get_informed/content_basic_view/2367_1
- ❖ National Domestic Violence Helpline: 800-799-7233
<http://www.thehotline.org/>

Providers should screen women with sensitivity to their culture, language, and literacy needs. This may require more individualized attention. All communication is held in strict confidence unless otherwise mandated by law.

PSYCHOSOCIAL BARRIERS

Significant barriers and stressors impede a patient's ability to actively participate with providers, and adhere to a treatment regime. Increases in severity and chronicity of the stressors will further diminish a woman's resiliency and coping. Health problems, poverty and intimate partner violence are examples of multiple stressors which can affect her ability to attend to her diabetes care. The providers' ability and skills to interact effectively with their patients can also be an asset or risk factor to a successful treatment plan and birth outcome.

PERINATAL DEPRESSION

Perinatal depression is often under-identified during and after pregnancy. Among low-income pregnant women with diabetes, perinatal depression occurs almost twice as often as among those women without diabetes.¹⁵ Beyond the "baby blues," the prevalence of perinatal depression ranges from 5-25% of women and is one of the most common perinatal complications.¹⁶

Many factors influence maternal mental health including^{15,17}:

- ❖ Family history of depression
- ❖ Hormonal changes
- ❖ Poor environmental factors
- ❖ Intimate partner violence
- ❖ Chronic stressors and trauma
- ❖ Oppression and racism
- ❖ Isolation from adequate social and community support

Some common signs and symptoms of depression include:

- ❖ Sleep and appetite disturbances
- ❖ Anxiety and/or irritability
- ❖ Unexpected weight loss/gain
- ❖ Loss of interest or pleasure in life
- ❖ Hopelessness
- ❖ Loss of energy and motivation
- ❖ Thoughts of harming oneself or another

Providers should keep in mind that:

- ❖ The rates of depression in the second and third trimesters are reported to be as high as during the postpartum period, making this time period assessment important for CDAPP Sweet Success clients. Depression is seen as both a response to the overwhelming psychosocial stressors of a patient's life and also as a result of biochemical changes related to diabetes and its treatment.

Depression and Maternal-Child Attachment

Maternal depression is a multifaceted illness that has varying consequences for a woman's mental health, her functioning as a mother, her family's functioning, maternal-child attachment and her child's development in many ways. For example, postnatal depression can:

- ❖ Negatively impact attachment behaviors, such as an infant's attunement to emotional signals of their mother's voice, gestures, and facial expressions¹⁸
- ❖ Limit breastfeeding duration and success
- ❖ Impede neural development of infants
- ❖ Impair a woman's ability to relate to her infants' needs and increase the risk that she develop negative attitudes toward her children
- ❖ Increase insecure attachment behaviors between infants and their mothers¹⁸
- ❖ Result in children developing fewer positive emotions than children of non-depressed mothers

Edinburgh Postnatal Depression Scale (EPDS)

The Edinburgh Postnatal Depression Scale (EPDS) is a simple ten item screening tool for anxiety and depression. It is useful during the entire perinatal period and through the first year of life.¹⁹ As the EPDS is a screening tool and not a diagnostic instrument, it is not a substitute for sound clinical judgment. It does not diagnose depression or anxiety but just screens for symptoms.

A provider may be uncertain about how to address a woman's sense of well-being. A simple discussion may begin with stating, "We ask all pregnant women, especially those dealing with diabetes, about how they are feeling. We'd like to know a little about your emotional health, what is important to you and your family, and how you care for yourself."

Barring the rare situation requiring emergency intervention, providers are not required to "fix" the problems of a woman's life. Appropriate referrals may be beneficial in some cases. Often her sense of distress can be reduced by acknowledging her suffering.

- ❖ The use of EPDS screening tool
Staff needs to be trained before screening for anxiety and depression is integrated into care. After being trained, using the screening tool, scoring it and developing an action plan based on the findings, all health care team members should be able to screen diabetic women.

Ideally, providers should screen patients once during the following time periods in order to identify most women who experience perinatal depression:

- The second trimester
- The third trimester
- Six weeks postpartum
- Three months after delivery

Administering and Scoring the EPDS

A woman is provided an EPDS sheet with 10 questions and she underlines the answer that most closely reflects how she has felt during the last seven days. Providers can assist a low literacy woman, but should be careful not to influence her answers. They should also be aware if anyone with her is influencing her responses. Each answer has a number score. A total score of more than twelve points warrants clinical attention.

Modes of Treatment for Perinatal Depression

Key to supporting a women's well-being is to increase awareness and education about stress, depression and anxiety among providers, family members and women themselves. Mild depression and anxiety symptoms benefit from supportive relationships and psycho-educational materials.

Dysthymia (moderate depression), major depression disorder and other psychiatric disorders require careful coordination with a mental health professional and/or a BMS consultation and educational materials for the woman and her family. The following are treatment options:

- ❖ Counseling/Psychotherapy particularly cognitive behavioral therapy (CBT), a treatment that has proven to be effective in reducing depressive symptoms and improving problem-solving skills and interpersonal psychotherapy.²⁰
- ❖ Exercise which is important to maintain blood glucose and enhance well-being and improve their mood.
- ❖ Prescription of psychotropic medication requires a careful risk-benefit analysis, weighing the consequences of untreated depression and the use of medications in pregnancy.²⁰

Knowledge of current research and coordination with psychiatry is critical.

Postpartum Assessment

The postpartum period is a time of heightened emotional and physiological vulnerability. A postpartum assessment should be completed for all women, whether they had positive birth outcomes or experienced losses such as therapeutic or spontaneous abortions, ectopic pregnancies, having a baby with birth defects, still births or neonatal death. The postpartum evaluation should be completed earlier than six weeks if indicated by psychosocial history.

For women who have become attached to the diabetes treatment team, exiting the program may be very difficult. For some, this is one of the few times in their lives when someone has paid attention to their psychosocial needs and provided them with significant support. These women may be more vulnerable to postpartum depression. A woman

who has experienced a high-risk pregnancy and/or difficult delivery is also more vulnerable to depression. She may be experiencing feelings of guilt or loss.^{3,21} She may also feel let down from decreasing the intense energy she has used to adhere to the expectations of the program.

Additionally, this might be the ideal opportunity for the patient to be empowered toward positive lifestyle changes for herself and her family. Spacing future children is essential to a healthy start for her next pregnancy as well as the woman's physical and mental health. Providing women with information on birth control will increase the chances of preconception care.

**RESOURCES AND
WEBSITES -
PERINATAL
DEPRESSION AND
ANXIETY**

All women and their families benefit from receiving written materials which includes community resources, and crisis numbers for services available in their areas.

- ❖ Phones: Hotlines and Warmlines- (English/Spanish)
Postpartum Support International 1.800.944.4773
<http://www.postpartum.net/>
- ❖ Online resources
www.mededppd.org/mothers
<http://www.motherisk.org/women/index.jsp>
www.beyondblue.org.au
<http://ctispregnancy.org/>

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CDAPP Sweet Success

Guidelines

for Care

Chapter 10

Cultural Competency



California Diabetes and Pregnancy Program Sweet Success Guidelines for Care

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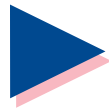
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10 Cultural Competency

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10 Cultural Competency

INTRODUCTION

“The world in which you were born is just one model of reality. Other cultures are not failed attempts at being you; they are unique manifestations of the human spirit.”

Wade Davis

This section addresses the importance of understanding the influence of a woman’s culture on her health choices. It provides the LEARN Model (crafted by Berlin and Fowkes ©BMJ)¹ to guide health care providers to provide culturally sensitive care.

CULTURE, PREGNANCY AND DIABETES

People’s cultural background affects their health practices and their response to physiological changes and illness.² A pregnant woman with diabetes who comes from a cultural tradition different from those of the caregivers may have difficulty accepting medical interventions. This is especially true when these medical practices contradict or violate her cultural values and health beliefs.³ In times of stress, like the experience of diabetes during pregnancy, a patient may adhere fervently to early-learned nutritional, behavioral, and spiritual traditions, as they provide comfort for her to cope with anxiety and uncertainty.⁴

Since attitudes and beliefs about health protection and healing are essential components of cultural practices, the health beliefs among CDAPP Sweet Success patients vary. Learning about the many different cultures is challenging and requires providers to LEARN, as explained below.¹

As a provider, conversations with your patient will reveal her perceptions of the importance of health practices and any potential conflicts she might feel in following her plan of care. For example, she may feel that insulin will hurt her and the baby, rather than helping her to control her diabetes. In the patient’s culture, the family’s influence on her self-care and diabetes management might be greater than is assumed. To avoid misconceptions, ask the woman about her beliefs, and pay attention to her responses and those of her family members.

Acculturation

Acculturation refers to the extent of a person’s integration of her new culture with her culture of origin. In addition to their diverse cultural background, patients also differ in their process of acculturation. As a provider you want to teach your patient American ways of managing diabetes with respect for her cultural expectations and pregnancy needs.

You want to know how many of her cultural beliefs and practices have been adapted to American culture and its practice of medicine. Information regarding the following issues will give you a sense of her level of acculturation.⁵

Some questions which you may consider include:

- ❖ How often does she return to her country of origin?
- ❖ Does anyone from her country of origin live in the home with her?
- ❖ Who does her grocery shopping and food preparation?
- ❖ Is her community consistent with her ethnic background?
- ❖ Does obstetric care in this country differ from her country of origin?
- ❖ How is diabetes treated in her country of origin?
- ❖ What are her expectations of managing her diabetes in pregnancy?

By observing and listening to your patient, you will become aware of her ease in understanding and speaking English. If she is not fully comfortable with her ability to communicate in English, it is crucial to use interpreter services at every visit. Asking family members to translate is likely to cause emotional strain and conflict, and should be avoided.

UTILIZING AN INTERPRETER

Healthcare interpreters are trained to understand, communicate and translate language differences. They can often provide clarification of cultural beliefs, values, and traditions that may interact with the patient's ability to understand and adhere to her treatment. For women who are not fluent with English, these interpreter services are recommended during all appointments. The California Healthcare Interpreting Association website is:

- ✓ <http://www.chiaonline.org/>

The LEARN Model

Health care team members can utilize the **LEARN** model to assist them to improve their cross-cultural communication. This model was crafted by Berlin and Fowkes (©BMJ) and is as follows¹:

LEARN stands for:

- Listen
- Explain
- Acknowledge
- Recommend
- Negotiate

The LEARN model¹ is a useful technique that has been used in health care settings for over 30 years. This approach can assist team members to develop cultural sensitivity and competence, which are required skills for all team members.⁶ The following sections suggest how team members can LEARN about the patient's cultural values and beliefs about pregnancy and diabetes.¹

Listen

Listen for the patient's thoughts and feelings.

- ❖ What are the patient's beliefs about diabetes and treatment methods?⁷
- ❖ Do other family members have diabetes?
- ❖ How have they treated their diabetes and what have been their outcomes?
- ❖ What are the cultural expectations for a woman who is pregnant?

Cultures differ widely in their views about the value placed on exercise, requirements for food, rest and sleep, ingestion or injection of medications, and personal rituals during pregnancy.⁸ In addition, a family's division of labor between generations and male and female is often highly regulated and the patient may feel that she must respect those rules first and foremost.⁴ Do these cultural expectations conflict with the team's recommendations?⁸

- ❖ What do pregnant women eat in the patient's culture of origin? What foods are discouraged? What foods are encouraged as being wholesome for mother and for baby?
- ❖ Does she seem skeptical about the effects that certain food choices can have on blood glucose values and pregnancy outcome?
- ❖ Does she like to get her groceries in an ethnic grocery store where she may be expected to buy types and quantities of foods that are not part of her medical nutrition therapy plan?
- ❖ Is there a person of authority in the home who dictates food choices? Is this person involved with grocery shopping or cooking?

The woman may not have a support system from her country of origin and she may feel isolated from the help she needs to manage the diabetes and pregnancy on a daily basis.

- ❖ If she is foreign-born, listen for her feelings about giving birth outside of her native country.
- ❖ What support systems are available in her new location?
- ❖ Are there any problems related to legal or immigration status that may affect the woman's utilization of resources and her adherence with the CDAPP Sweet Success diabetes management program?

How to LISTEN:

- Give your patient your undivided attention using an attentive, open posture.⁷
- Refrain from taking notes.
- Allow moments of silence and aim for the patient to break the silence.
- Observe the patient's body language and whether it supports or contradicts her verbal language.
- Listen for both the content and emotion in what the client is saying.

Explain

Berlin and Fowkes explain that “Explanation or communication of a ‘Western medicine’ model is the next step.”¹ CDAPP Sweet Success providers must convey their reasoning and perception of the problem or of a particular diagnosis like diabetes to the patient and rationalize why their strategy would be beneficial for both the infant's wellbeing, but also the mother's overall health. How the health care team communicates these new findings and creates a treatment plan that involves the input of the patient is critical and impacts patient efforts. Communicate acceptance of the value that the woman places on maintaining her own traditional cultural practices.

- ❖ Communicate acceptance of the value that the woman places on maintaining her own traditional cultural practices. Many women experience sadness and grieve the loss of familiar family rituals and folkways that would have helped them during their pregnancy and in times of stress.
- ❖ Take extra time to articulate what the biomedical reasoning might be for a given issue which might help mitigate her own cultural rationale to *why* something bad is happening to her.
- ❖ Do not undermine her feelings, which may be tumultuous and contradictory.³
- ❖ Express empathy with the conflicts that a woman may experience in trying to comply with the diabetes program while at the same time her family expects her to cook and eat in traditional ways.

Once a woman feels that staff is genuinely interested and empathetic with her, she will likely become more trusting and more willing to make necessary modifications to her lifestyle to treat her diabetes. An ongoing trusting relationship between patient and provider, sensitive to the needs of the woman they serve, is critical.⁹

How to EXPLAIN:

- Communicate treatment needed in a way that doesn't undermine a women's cultural heritage, but explains what biomedical process can be improved if that treatment is met.
- Observe your own feelings in response to your client's disclosure.
- Note your intuitive responses to the patient's feelings and explain your perception of the issues faced by the patient in developing a treatment plan.

Acknowledge

- ❖ Acknowledge the value of the patient's cultural heritage as well as her expression of her culture's guidelines on health and healing.¹⁰
- ❖ Acknowledge the wisdom of mind-body tradition she may embrace.¹⁰ Patients can offer the staff a wealth of information about treating the whole person, including their cultural beliefs about pregnancy and diabetes management.
- ❖ Acknowledge that diabetes during pregnancy is different from diabetes for a woman who is not pregnant.
- ❖ Acknowledge the challenges she is facing in learning more ways to improve her health, using unfamiliar and often frightening modalities like glucose meters and syringes. She may feel overwhelmed by the new treatments and new and unknown terminology.
- ❖ Acknowledge that new things often seem frightening, for the patient as well as the family and friends.
- ❖ Acknowledge how her culture may have beliefs about the healing potential of certain foods. Promote two-way communication to gather information about food as medicine in different cultures.
- ❖ Acknowledge that an immigrant woman often has strong ties with family and friends in her native country that may be advising her about health and healing.⁸ A woman may frequently visit her native country to secure nutritional substances and medications believed to be helpful during pregnancy.
- ❖ If a woman is using any alternative health care approaches, advise her to discuss them with her physician, midwife, or nurse practitioner.^{7,8}
- ❖ Acknowledge that her family members may have to go through adjustments in adapting to American culture.
- ❖ Acknowledge that her knowledge is valuable and that her family will always benefit from her knowledge. Be an advocate for your client's medically safe traditions and wisdom.

How to ACKNOWLEDGE:

- Acknowledge what you heard, by restating or reflecting the patient's words.
- Acknowledge and clarify what you heard by asking open-ended questions.
- Acknowledge and advocate for your client's medically safe traditions and wisdom.

Recommend

- ❖ Recommend a treatment plan that emphasizes the goal of staying healthy for herself and the baby.
- ❖ Recommend ways to communicate with family members and friends who may question or undermine her use of regular glucose testing and insulin injection. The staff may use role playing to facilitate communication.
- ❖ Recommend ways to communicate with persons of authority such as the woman's employer or family members who may question her need to adhere to medical nutrition therapy. Staff may offer assistance as a medical contact for employers. A woman who is a recent immigrant may lack the confidence to request appropriate break times for glucose testing and food intake. Offering to role play the patient addressing this situation and allowing her to “practice” may be helpful. In addition, she may need assistance regarding occupational safety in terms of avoiding heavy lifting or exposure to toxins.
- ❖ Recommend incorporating as many ethnic foods and meal patterns as possible within the nutritional guidelines.
- ❖ Recommend that the woman communicate with her doctor about herbs and nutritional supplements if these are important to the patient.⁷

How to RECOMMEND:

- Develop SMART goals (Specific, Measurable, Attainable, Realistic, Timely).
- Be respectful of her conflicting feelings.
- Be respectful of the possible lack of support in her home life.
- Praise even the slightest progress.
- Instill hope.

Negotiate

Negotiation is an ongoing process. Each woman differs in her ability to adapt and to compromise. Staff continues to negotiate with her at each visit while trying to implement her diabetes care plan, in a culturally sensitive manner. For example, her goal for this pregnancy may be for a big baby, based on her family's values. This is in conflict with the staff's goal. Through negotiation, the staff and patient may resolve the difference.

- ❖ Through negotiation, alternative meal plans can still connect a woman with her cultural identity and heritage.
- ❖ Once a woman's fears of criticism or judgmental attitudes about her cultural heritage are allayed, she is more likely to become aware of staff compassion and respect. This can set the stage for the woman to be open to receive support and guidance while coping with a pregnancy that is complicated by diabetes.

HOW TO NEGOTIATE:

- Be creative in coming up with choices to be negotiated.
- Ask ethnic community liaisons for advice.
- Include logistical issues in the negotiation process such as living in ethnic enclaves or trying to straddle different cultures.
- Be sensitive to the patient's sense of betraying her cultural heritage and allow her time to adjust.

**POSTPARTUM CARE
WITH CULTURAL
CONSIDERATIONS**

In the post-partum period, the team should listen with empathy and respect for culture-based expectations and beliefs regarding recovery from childbirth and attachment to the infant. They should observe for signs of depression and the need for treatment.

Some beliefs and feelings to listen for include:

- ❖ What does your patient expect in the postpartum period?
- ❖ Do cultural traditions conflict with her present cultural surroundings?
- ❖ What are her fears and who and what comforts her?
- ❖ How can you engage her to seek help if needed?

The expectations of postpartum care may vary depending on the culture. Some new mothers expect a special time of rest (e.g. cuarentena) with nurturing and loving care from family and friends. Studies in China, Malaysia, and Taiwan have shown that women who receive traditional postpartum rest periods have less postpartum depression. These periods of postpartum resting do not necessarily mean that new mothers are isolated from family activities.

While American ways may be admired in diverse ethnic groups, there may also be strong fears about invasive medical technology resulting in vulnerability. This is particularly true if the mother or newborn's health requires special medical testing and treatments. In this country, medical practitioners generally assume that it takes six weeks for women to regain internal organ and tissue function after giving birth.¹¹ Rest is commonly accepted as aiding in the healing process. Family, neighbors, and friends can do a great deal to help a new mother to find some time for rest thus joining ancient wisdom and modern science.

**CULTURAL DIVERSITY
IN BREASTFEEDING**

Cultural norms, values, beliefs, and level of acculturation influence a woman's decision on whether or not she will breastfeed her baby. Experiences with breast feeding in her own extended family also affect a woman's choice¹², especially if she still has close ties to her mother, sisters, or aunts.

Her level of acculturation affects breastfeeding choices as much as it affects other health-related choices. Again, the LEARN model¹ will be helpful to understand the patient's beliefs about breastfeeding. Many cultures have strong traditions about skin-to-skin contact for mother and baby to initiate breastfeeding. Babies are more likely to be breastfed and for a longer time if they are allowed early skin-to-skin contact and are also more likely to have a good early relationship with their mothers.¹³

SUMMARY

For all its positive accomplishments, western medicine often ignores perinatal traditions of other cultures. Many non-western cultures do not accept the cause and effect explanations used by western medicine. The talking points suggested in this chapter are designed to help the health care team improve their communication with their clients. Once the caregiver understands the client's cultural value and beliefs for healing practices, her choices concerning healthcare are usually logical. Using the LEARN model¹, each team member can play an essential role in providing culturally sensitive care. Providers can use these tools to broaden their own views about health and healing.

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