

# *CDAPP Sweet Success*

# *Guidelines*

# *for Care*

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## **State Program Guide**

California Diabetes and Pregnancy Program:  
Sweet Success

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**California Department of Public Health,  
Center for Family Health  
Maternal, Child & Adolescent Health Division  
2012**

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California Diabetes and Pregnancy Program

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## **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
DCCT	Diabetes Control and Complications Trial
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
GDM A1	Gestational Diabetes Mellitus, Diet Controlled
GDM A2	Gestational Diabetes Mellitus, Oral Meds/Insulin Controlled
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
NGSP	National Glycohemoglobin Standardization Program
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

**For more information:**

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# ▶ *CDAPP Sweet Success* *Guidelines* *for Care*

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## Chapter 1

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## Overview



*Sweet Success*  
California Diabetes and Pregnancy Program

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## 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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# 1 Overview

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# 1 Overview

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## 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 federal Title V Block Grant through the California Maternal, Child and Adolescent Health (MCAH) Division.

From 1984 through 2006, the number of CDAPP regional programs gradually expanded to ten. Regional CDAPP staff recruit, train, support and retain local CDAPP Sweet Success Affiliates who provide health care services to pregnant women with preexisting or gestational diabetes. Prior to CDAPP, pregnant women with diabetes received minimal intervention. Today, CDAPP 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 the ten CDAPP Sweet Success Regions will end in June 2012. MCAH is developing a new CDAPP Sweet Success Resource and Training Center to continue to support and meet the needs of CDAPP Sweet Success Affiliates.

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## 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 strives to optimize maternal and fetal 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 is to improve maternal and fetal birth outcomes through health education and promotion, and disease prevention. The CDAPP Resource and Training Center staff recruit, train, support and retain local 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 the 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 Resource and Training Center who develops and maintains web-based training and disseminates valuable diabetes resources. 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:
  - o Use the CDAPP Sweet Success Guidelines for Care.
  - o Utilize interdisciplinary health care teams to provide preventive and health promoting strategies that are culturally appropriate and research-based.
  - o Collect and analyze clinical data for validation of services to patients and for quality improvement (QI) activities.

---

## FUNDING

CDAPP Sweet Success is a project of California Department of Public Health; Center for Family Health; Maternal, Child, and Adolescent Health Division. MCAH State Program Consultants for CDAPP provide direction and oversight in communicating the Title V goals and objectives to the CDAPP Sweet Success.

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

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

The CDAPP Sweet Success Affiliate Program is accomplished 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 for CDAPP Sweet Success who provide direction and oversight in communicating the MCH Title V goals and objectives to the CDAPP Sweet Success.

CDAPP Sweet Success Resource and Training Center provides:

- ❖ Development of CDAPP Sweet Success materials, brochures, updates to “CDAPP Sweet Success Guidelines for Care”, educational webinars, and the CDAPP Sweet Success website.
- ❖ CDAPP Sweet Success materials available to affiliates and providers in print and electronic formats.
- ❖ Promotion through CDAPP Sweet Success printed materials
- ❖ Development of web-based training for existing and new CDAPP Sweet Success affiliates and assistance to them to maintain their Memorandum of Understanding (MOU) as an affiliate, and the on-line affiliate directory by County.
- ❖ 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.
- ❖ Completion of 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 yearly 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 annual goals and long-term plans with the CDAPP Sweet Success staff through 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://cdph.ca.gov/CDAPP>

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### AADE 7<sup>TM</sup> SELF-CARE FRAMEWORK

The American Association of Diabetes Educators (AADE) created a framework known as the AADE 7<sup>TM</sup> Self-Care Model. This AADE Self-Care Framework will be utilized throughout the CDAPP Sweet Success Guidelines for Care. It is listed in the table below:

<b>Table 1 SELF-CARE BEHAVIORS RECOMMENDED BY AADE</b>
1. Healthy eating-making healthy food choices, understanding portion sizes and learning best times to eat
2. Being active - important for overall fitness and reduces risk for DM2
3. Monitoring – to include 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 – smoking cessation, regular eye, foot and dental examinations
7. Healthy coping – affected by psychological and social factors
Source: American Association of Diabetes Educators (AADE) website: <a href="http://www.diabeteseducator.org/ProfessionalResources/AADE7/">http://www.diabeteseducator.org/ProfessionalResources/AADE7/</a> accessed 07/12/2012

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### 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.

---

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## Chapter 2

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### Preconception and Interconception Care for Preexisting Diabetes



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# 2 Preconception and Interconception Care for Preexisting Diabetes

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## *2 Preconception and Interconception Care for Preexisting Diabetes*

The “Preconception-Inter-conception Care for Preexisting Diabetes” section of the California Diabetes and Pregnancy Program (CDAPP) Guidelines for Care 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 inter-conception time between pregnancies.

This section includes several Tables to guide the provider and staff to provide Preconception and Interconception care.

---

### **INTRODUCTION TO PRECONCEPTION CARE**

Preconception Health Care, defined below by the Center for Disease Control and Prevention (CDC) is recommended not just for women with preexisting diabetes but for all women.

CDC notes, “Preconception care is comprised of interventions that aim to identify and modify biomedical, behavioral and social risks to a woman’s health or pregnancy outcome through prevention and management, emphasizing those factors to be acted on before conception or early in pregnancy to have maximal impact. It includes care before a first pregnancy or between pregnancies, commonly known as inter-conception care. While the predominant component addresses women’s health, it includes interventions directed at males, couples, families and society at large” (1).

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 400 mcg folic acid daily from supplements or in addition to intake of folate rich food. Once pregnant, the dose should be increased to 600 mcg until the end of the first trimester (2). The upper intake limit is 1000 mcg per day.

**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.

<p><b>Table 1. GOALS OF PRECONCEPTION CARE (3)</b></p> <p>To prevent excess spontaneous abortions and congenital malformations in infants of diabetic mothers. This is achieved by:</p> <ul style="list-style-type: none"> <li>❖ Assuring effective contraception until stable and acceptable glycemia is achieved</li> <li>❖ Assisting women to achieve an A1c &lt;6.5% prior to conception</li> <li>❖ Identifying, evaluating, and treating long-term diabetes risks and complications that may affect pregnancy</li> </ul>
---

## 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 about 10% of pregnancies (4, 5, 6, 7). 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 complications (8, 9, 10), and face a greater risk of preeclampsia, pyelonephritis, polyhydramnios, preterm birth, cesarean delivery and birth trauma (3, 4, 11). While preconception care is strongly recommended, only 25-30% of childbearing age women with diabetes seek this care (11). The CDAPP providers strive to improve these statistics.

The CDAPP demonstrated that when women enrolled in the program prior to pregnancy and achieved good control ( $A1c < 7$ ); they had significantly reduced major fetal anomalies; 1.4% 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 or without diabetes sees a health care provider, it should be regarded as a preconception visit (12).

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 meal 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.

<b>Table 3. ASSESSMENT, PHYSICAL EXAMINATION AND LABS FOR WOMEN WITH PREEXISTING DIABETES (3, 4, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19)</b>			
<b>Categories/ Complications/ Recommended Test/ Frequency</b>	<b>Target</b>	<b>History/ Signs and Symptoms</b>	<b>Rationale /Risk</b>
<b>Glycemic / Metabolic Control</b>			
<p><b>Glycemic Control</b>  <b>A1c:</b> Repeat every 3 months throughout pregnancy.</p> <p><b>SBGM:</b> Minimum fasting, premeal, post meal, bedtime, overnight, and additional testing for suspected hypo/hyperglycemia.</p>	<p>≤ 6.5%</p> <p>Less than 20% values outside of targets</p>	<p>History of diabetic ketoacidosis, or hypoglycemia and patient awareness of signs, symptoms for these</p>	<ul style="list-style-type: none"> <li>• A1c &lt; 6.5% lowers risk of birth defects and SAB to non-diabetic population incidence.</li> <li>• History of severe hypoglycemia or unawareness may necessitate elevated targets.</li> <li>• Pregnancy lowers the ability of some women to sense hypoglycemia.</li> <li>• Glucose control with less than 20% of values out of range appears to be adequate.</li> </ul>
<p><b>Lipids:</b>                      Fasting Lipid/ Triglyceride levels</p> <p>If fatty liver disease is suspected check AST/ALT, and obtain liver ultrasound.</p>	<p>TG ≤ 150 mg/dl                      HDL ≥ 50 mg/dL                      LDL ≤ 100 mg/dl</p>	<p>Assess for history of abnormal lipids</p> <p>Fatty liver is associated with high BMI, and difficult glucose control. Associated with type 2 diabetes</p>	<ul style="list-style-type: none"> <li>• Increase with insulin resistance and deficiency.</li> <li>• Associated with cardiovascular events and fatty liver.</li> <li>• Dietary intervention and lifestyle, is the primary approach.</li> <li>• Statin therapy is contraindicated in pregnancy.</li> <li>• Fish oil and niacin have been used in pregnancy. Bile-acid binding resins are approved. Other agents should be used on individualized basis.</li> <li>• Fatty liver is treated with dietary, lifestyle and glycemic control and is associated with late term fetal loss.</li> </ul>
<b>Endocrine</b>			
<p><b>Thyroid:</b>                      TSH / T4                      If normal no follow-up required.</p> <p>Abnormal TSH: follow-up preconception, each trimester and postpartum.</p> <p>Thyroid Peroxidase Antibodies TPOAbs                      If negative no F/U needed.</p>	<p>TSH &lt; 4.5 mIU/mL (or &lt;2.5 1st trimester)</p> <p>If being treated                      T4 &gt; 4.5 ug/dL or                      Free T4 8-22 mmol/L</p> <p>Negative</p>	<p>If a woman has a history of hyper-or hypothyroid evaluate labs before and during pregnancy to adjust treatment</p>	<ul style="list-style-type: none"> <li>• Abnormal thyroid function effects fertility and increase risk of loss. Treatment and follow-up is recommended.</li> <li>• Hypothyroid increases hypoglycemia incidence and can effect fetal brain development.</li> <li>• Autoimmune thyroid disease is common with type 1 diabetes (35-40%).</li> <li>• Alert the pediatrician for positive TPOAbs and treatment.</li> </ul>

<b>Table 3. ASSESSMENT, PHYSICAL EXAMINATION AND LABS FOR WOMEN WITH PREEXISTING DIABETES (3, 4, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19), Continued</b>			
<b>Categories/ Complications/ Recommended Test/ Frequency</b>	<b>Target</b>	<b>History/ Signs and symptoms</b>	<b>Rationale /Risk</b>
<b>Macrovascular</b>			
<b>Hypertension</b> Test blood pressure (BP) at every office visit.	Systolic BP ≤ 130  Diastolic BP ≤ 80		<ul style="list-style-type: none"> <li>Medication for hypertension should be evaluated for use in pregnancy.</li> <li>ACE and ARBs are contraindicated in pregnancy, and associated with increased incidence of gestational hypertension, preeclampsia, and IUGR.</li> <li>Uncontrolled hypertension is associated with progression of retinopathy.</li> </ul>
<b>Cardiovascular</b>			
<b>EKG recommended for:</b>  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: exercise intolerance; pain or heaviness in chest, neck, jaw, left arm; shortness of breath; vascular disease in extremities.	<ul style="list-style-type: none"> <li>Appropriate treatment will reduce the significant mortality and morbidity associated with CVD.</li> <li>Counseling per potential needs and risks.</li> <li>Generally women with suspected cardiovascular disease should be referred to a cardiologist who should be included in the team.</li> </ul>
<b>Skin and Food Care</b>			
Assess patient knowledge and instruct as necessary.	No skin breaks. Performs regular foot care.	Assess history of skin breaks, foot care and infections.	<ul style="list-style-type: none"> <li>Any skin breaks leave a woman open to infection and adversely effect glucose control.</li> <li>Foot deformities will affect exercise prescription.</li> </ul>
<b>Microvascular</b>			
<b>Nephropathy:</b> Urine dip for micro-albuminuria, serum Creatinine  <ul style="list-style-type: none"> <li><b>If abnormal</b> send for 24 hour Total protein, creatinine clearance with a serum creatinine.</li> <li><b>If abnormal</b> follow preconception, every trimester and more often if indicated.</li> </ul>	Microalbumin Dip ≤ 30 mg is normal  Total Protein < 150 mg/24 hr  Creatinine clearance 0.7-.09 mg/dL and GFR (Glomerular Filtration Rate) > 60 m/min/m <sup>3</sup>	Associated with hypertension and hypertensive diseases of pregnancy, and retinopathy.	<ul style="list-style-type: none"> <li>Mild to moderate renal insufficiency does not appear to worsen after a gestation. Moderate to severe renal dysfunction has been associated with long-term progression.</li> <li>GFR 60-98 and proteinuria &gt; 500 mg/day are associated with increased incidence of IUGR, fetal demise, and preterm delivery.</li> <li>Referral to a nephrologists is recommended.</li> <li>Dietary intervention may be indicated.</li> </ul>
<b>Retinopathy</b> 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"> <li>Achieving tight glycemic control slowly may prevent rapid retinal progression. This is not an option if presenting in pregnancy.</li> <li>Blood pressure control reduces progression.</li> <li>Proactive treatment such as laser or vitrectomy, is encouraged, as the risk for vision loss during a pregnancy can be significant.</li> </ul>

<b>Table 3. ASSESSMENT, PHYSICAL EXAMINATION AND LABS FOR WOMEN WITH PREEXISTING DIABETES (3, 4, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19), Continued</b>			
<b>Categories/ Complications/ Recommended Test/ Frequency</b>	<b>Target</b>	<b>History/ Signs and symptoms</b>	<b>Rationale/ Risk</b>
<b>Neuropathy</b> 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"> <li>Hypoglycemia without warning symptoms may require adjusted glucose targets to protect the woman and potential offspring.</li> </ul>
Gastrointestinal (Gastroparesis)  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"> <li>Associated with increased mortality and poor perinatal outcomes.</li> <li>Treat with standard medications for hyperemesis.</li> </ul>
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"> <li>With cardiovascular autonomic neuropathy a woman will require a modified exercise prescription.</li> <li>Associated with increased perinatal complications and requires cautious management.</li> </ul>
Acute Sensory Neuropathy  Chronic Sensorimotor Distal Peripheral Neuropathy (DPN)  Mononeuropathies  Entrapment	<ul style="list-style-type: none"> <li>Without leg pain.</li> <li>Normal, vibration, pressure, pain, temperature perception and ankle reflexes</li> <li>Nerve conduction amplitude is normal</li> <li>Electrophysiologic studies show no block in conduction</li> </ul>	<ul style="list-style-type: none"> <li>Pain in legs</li> <li>Burning pain, stabbing; hyperaesthesia, deep aching, usually worse at night.</li> <li>Weakness and palsies</li> <li>Carpal tunnel syndrome</li> </ul>	<ul style="list-style-type: none"> <li>Changes in glycemic control can exacerbate pain.</li> <li>Neuropathy is associated with an increased injury risk.</li> <li>Increased perinatal complications and requires cautious management.</li> </ul>
<b>Other</b>			
<b>Oral Health:</b> 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"> <li>Periodontal disease is a chronic oral infection and is associated with difficult glycemic control and pregnancy complication.</li> <li>Most effective when identified and treated before pregnancy.</li> </ul>
<b>Celiac Disease:</b> 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"> <li>Untreated disease will have erratic blood glucose control.</li> <li>Treat with dietary intervention.</li> </ul>

**SELF  
MANAGEMENT  
BEHAVIORS**

The American Association of Diabetes Educators (AADE) Self Management Behaviors were briefly outlined in the overview section. These behaviors are explained in more detail in relation to preconception and inter-conception. They apply at all ages and stages of diabetes care and management (20).

**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. The **Medical Nutrition Therapy Chapter (Ch 7)** 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, 30 minutes 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.

<b>Table 4. EXERCISE PRECAUTIONS FOR WOMEN TAKING GLUCOSE LOWERING AGENTS (3)</b>
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) Pump (3, 21)

- ❖ 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% and with intense exercise, a 50% reduction in basal rate.
- ❖ 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 at least 30-60 minutes before the exercise and continue the temporary basal rate for the duration of the exercise.

For a more detailed discussion of physical activity refer to the [Exercise Chapter \(Ch 6\)](#).

### Monitoring of Blood Glucose

- ❖ **Self-Monitoring Blood Glucose**  
Women with preexisting diabetes should be advised that intensive self-monitoring 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 pregnancy.
- ❖ **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.



<b>Table 5. FREQUENCY OF SELF MONITORING BLOOD GLUCOSE (SMBG) (3, 19, 22, 23, 24)</b>	
<b>Type of Diabetes</b>	<b>When to Test</b>
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 (12).

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

<b>Table 6. TARGET BLOOD GLUCOSE FOR PRECONCEPTION/ PREGNANCY (3, 19, 22, 25, 26, 27, 28)</b>	
<b>Timing of Test</b>	<b>Desired Blood Glucose Range</b>
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, 7, 29). The A1c test is an important measure during preconception since control of blood glucose

reflected by an A1c test of < 6.5 prior to pregnancy is associated with a reduced rate of congenital malformation (3, 29).

Hemoglobin A1c is monitored every 3 months in the preconception period and the goal is to attain and maintain an A1c level of <6.5% 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 (30).

#### ❖ 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 (31, 32).

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 (22, 25, 26).

#### ❖ 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, and exercise, or during suspected hyperglycemia or hypoglycemia (21).

#### ❖ Gastroparesis

Women with gastroparesis or delayed gastric emptying prior to pregnancy, will need to identify their individual post meal glucose peak. Modified meal planning and medications may be indicated

(3) (refer to the [Medical Nutrition Therapy Chapter \(Ch 7\)](#) 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 109-130 and a diastolic blood pressure of 64-80. 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, 34). 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 (35). This information is summarized in Table 7:

<b>Table 7. PRECONCEPTION RECOMMENDATIONS FOR ANTIHYPERTENSIVE MEDICATIONS</b> (Target BP<130/80) (3, 33, 34, 35, 36)	
<b>Recommended</b>	<b>Not Recommended</b>
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 most 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:

<b>Table 8. LIPID LOWERING INTERVENTIONS AND MEDICATIONS (3)</b>		
Primary Intervention	Secondary Intervention	Not Recommended
<ul style="list-style-type: none"> <li>❖ Encourage omega-3 fatty acid intakes of 3-9 gms per day.</li> <li>❖ Limit saturated fat to &lt;7% of calories.</li> <li>❖ Limit cholesterol to &lt;200mg/ day.</li> <li>❖ Replace transfats with monounsaturated fatty acid (MUFA) and polyunsaturated fatty acids (PUFA).</li> <li>❖ Intensify glycemic control</li> <li>❖ Walk for 20 minutes after meals.</li> </ul>	<ul style="list-style-type: none"> <li>❖ Slow-release Niacin use is limited by tendency to raise blood glucose. Insulin dose must be adjusted to compensate.</li> <li>❖ Bile acid-binding resins are category B, but of limited effectiveness when used alone. Should be used with dietary interventions or Niacin.</li> </ul>	<ul style="list-style-type: none"> <li>❖ Continue all lipid lowering medications (statins) until actively attempting pregnancy. Once pregnancy is attempted statins are <b>contraindicated.</b></li> </ul>

The **Medical Management and Education for Preexisting Diabetes Chapter (Ch 3)** 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 (36, 37, 38). 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 education 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 post meal blood glucose levels. Regular insulin is less effective in lowering the 1 hour peak glucose, and less convenient to administer (3, 11, 13, 39). 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 (11, 13, 39). At this time the rapid acting insulin analogs lispro and aspart, and NPH are the preferred insulins for pregnancy.

Basal insulins (NPH, glargine & detemir) are used to control between-meal and overnight blood glucose levels. Women on glargine and detemir should consider switching to intermediate-acting NPH or to a continuous subcutaneous insulin pump before becoming pregnant (11, 21, 39).

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 (11, 21, 39).

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 the [Medical Management and Education for Preexisting Diabetes \(Ch 3\)](#) chapter for a comprehensive review of insulin.

### *Continuous Subcutaneous Insulin Infusion (11, 21, 39)*

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 (11, 21).

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 (11, 21). Refer to [Medical Management and Education for Preexisting Diabetes \(Ch 3\)](#). Table 9 summarizes preconception recommendations for women with type 2 diabetes.

<b>Table 9. PRECONCEPTION RECOMMENDATIONS FOR MEDICATIONS WITH TYPE 2 DIABETES (3, 11, 21, 36, 37, 38, 39)</b>	
Recommendations	Rationale
❖ Switch from oral glucose lowering agents (OGLA) to insulin when needed to maintain glycemic targets for at least 3 months before attempting conception.	❖ OGLA often do not provide adequate glycemic control during organogenesis.
❖ OGLA should not be discontinued until insulin can be started.	❖ Hyperglycemia is a known teratogen.
❖ 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.	❖ Hyperglycemia is a known teratogen ❖ Neither glyburide nor metformin has caused developmental toxicity in humans in limited studies.
❖ 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 (insert link in nutrition)
- ❖ 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 the

[Medical Nutrition Therapy Chapter \(Ch 7\)](#).

- ❖ Hypoglycemia  
Table 10 describes clinical maneuvers to prevent and treat hypoglycemia.

<b>Table 10. PRINCIPALS FOR THE PREVENTION AND TREATMENT OF HYPOGLYCEMIA (40, 41, 42)</b>
❖ Balance activity and food with insulin.
❖ With the initiation of OGLA or insulin, educate regarding signs and symptoms of hypoglycemia.
❖ With the use of OGLA or insulin instruct to always carry quick acting carbohydrate snacks and glucose tabs.
❖ 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.
❖ Glucose targets may be raised for women with hypoglycemia unawareness.
❖ If hypoglycemia occurs follow the Rule of 15 (40) described below: <ul style="list-style-type: none"> <li>❖ Treat with 15 grams of carbohydrate</li> <li>❖ Re-check blood glucose in 15 minutes</li> <li>❖ Expect to see a rise of 15 mg/dL in 15 minutes</li> </ul>
If blood glucose > 50 < 70 + symptoms: <ul style="list-style-type: none"> <li>❖ Give 8 oz of non-fat milk. Recheck blood glucose in 15 minutes</li> <li>❖ Repeat milk if still &lt; 70 + symptoms</li> <li>❖ Repeat blood glucose every 15 minutes until blood glucose is &gt; 70 x 2</li> <li>❖ Use 1/2 sandwich if there is a milk allergy</li> </ul>
If blood glucose < 50 + Symptoms: <ul style="list-style-type: none"> <li>❖ Give 4 oz juice ( 4 (4mg) glucose tabs with water).</li> <li>❖ Recheck blood glucose in 15 minutes. If &gt; 50 + symptoms, give 8 oz of non-fat milk, otherwise repeat juice or tabs.</li> <li>❖ Repeat blood glucose check every 15 minutes until blood glucose &gt; 70 x 2. Have snack or next meal.</li> </ul>
If found unconscious: <ul style="list-style-type: none"> <li>❖ Call 911.</li> <li>❖ Give GLUCAGON 1 mg SC immediately.</li> <li>❖ May be given IM but will take longer to act.</li> </ul>

❖ **Hyperglycemia**

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

Hyperglycemia during the preconception or inter-conception 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, 4, 11, 13).

### 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 the Psychosocial Chapter (Ch 9) for more information).

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## SUMMARY

Table 11 addresses the optimal conditions for conception.

<b>Table 11. OPTIMAL CONDITIONS FOR CONCEPTION (3, 4, 11)</b>
1. A1c below 6.5%
2. Stable Normoglycemia (80% blood glucose in Target)
3. Demonstrates self care skills (AADE 7)
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

<b>Method</b>	<b>Considerations for women with preexisting diabetes and gestational diabetes mellitus</b>
Barrier Methods - condoms, diaphragm, cervical cap	<ul style="list-style-type: none"> <li>❖ Higher failure rates.</li> <li>❖ Condoms provide protection against HIV and STD's. Failure rates improve with the addition of spermicides.</li> </ul>
Hormonal Methods - birth control pills, injections, patches, vaginal rings, and implants	<ul style="list-style-type: none"> <li>❖ Prevent ovulation, require monitoring of weight, blood pressure, pre and post glucose, fasting lipids, and vascular screen.</li> <li>❖ Not recommended for women who smoke or have micro and/or macrovascular complications.</li> <li>❖ Increase the incidence of depression.</li> <li>❖ May affect lipids by decreasing HDL and increasing LDL and cholesterol.</li> <li>❖ Combination pills not recommended until breastfeeding is well established at 6 weeks to 3 months. Not shown to affect glucose intolerance.</li> <li>❖ Progestin only will increase glucose intolerance for preexisting DM and may require medication adjustment.</li> <li>❖ Progestin only for GDM will nearly triple the diabetes diagnosis above women using non-hormonal methods while breastfeeding. It is not recommended.</li> </ul>
Spermicides	<ul style="list-style-type: none"> <li>❖ High failure rates of 14 - 30% if used alone.</li> <li>❖ Due to high failure rate of this method, women should be offered on going preconception care.</li> </ul>
IUD	<ul style="list-style-type: none"> <li>❖ Up to 99% effective at preventing pregnancy.</li> <li>❖ Those that contain hormones do not have a systemic effect on blood glucose.</li> </ul>
Natural Family Planning - periodic abstinence, calendar method, ovulation method, symptothermal method, continuous breastfeeding, and withdrawal.	<ul style="list-style-type: none"> <li>❖ Significant failure rates of 0.2 - 27%.</li> <li>❖ Due to high failure rate of this method, women should be offered on going preconception care.</li> </ul>
Sterilization	<ul style="list-style-type: none"> <li>❖ Surgical procedure, usually not reversible.</li> </ul>
Emergency Contraception	<ul style="list-style-type: none"> <li>❖ 1 - 2% failure rate and is only method post sexual activity.</li> <li>❖ Progestin in these products may temporarily disrupt glucose control.</li> </ul>

***For more information:***

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<http://www.CDAPPSweetSuccess.org>



# ▶ *CDAPP Sweet Success* *Guidelines* *for Care*

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## Chapter 3

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### *Medical Management and Education for Preexisting Diabetes During Pregnancy*



*Sweet  
Success*

California Diabetes and Pregnancy Program

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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*

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## **INTRODUCTION**

Pregnancy profoundly affects the management of Preexisting Diabetes Mellitus (PDM) (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 six-fold 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 is 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 and the consultation of a maternal fetal medicine physician, and a multidisciplinary team of certified diabetes educators, including 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-Management Behaviors (8). These serve as a framework for assessment, planning, education needs and help to achieve the goals and objectives of prenatal care. The AADE 7 behaviors listed below are also addressed in the postpartum section in this chapter and the

**Preconception and Interconception Care Chapter (Ch 2).**

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 **Medical Nutrition Therapy Chapter (Ch 7)** 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 the [Exercise Chapter \(Ch 6\)](#) 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 essential component of diabetes therapy during pregnancy. In preparation for visits, a food diary and blood glucose record are maintained and utilized to optimize interventions towards tight control. Finger stick SMBG is best in pregnancy, since alternate site testing (use of interstitial fluid glucose) may not identify rapid changes in glucose concentrations. Daily SMBG, as described in Table 1, will provide crucial information.

<b>Targets</b>	<b>Frequency</b>	<b>Rationale</b>
<p><b>Premeal</b>, bedtime, and overnight: 60–99 mg/dl,</p> <p><b>Peak</b> postprandial glucose 100–129 mg/dl, (usually 1hr from first bite of carbohydrate)</p> <p><b>Mean</b> daily glucose &gt;87 and &lt;110 mg/dl</p> <p>These targets must be individualized to prevent persistent or severe hypoglycemia.</p>	<p>Self-monitoring of blood glucose (SMBG): before and after meals, snacks, at bedtime, and occasionally over night at 2-4 A.M.</p> <p>Continuous glucose monitoring (CGM) may be a supplemental tool to SMBG for selected patients, especially those with a strong Dawn Phenomena (rise in blood glucose before awakening) or hypoglycemia unawareness.</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"> <li>Elevated postprandial glucose values were most strongly associated with excess birth weight in the studies in which both pre and postmeal glucose were measured.</li> <li>Infants who experience hyperinsulinemia in utero are more likely to develop obesity, HTN and diabetes later in life.</li> <li>Extremely tight control (mean daily glucose &lt;87 mg/dL) is associated with restricted fetal growth.</li> </ul> <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 [Preconception Chapter \(Ch 2\)](#) for medication alternatives that are safe in pregnancy. Understand insulin administration, storage, expiration and availability of supplies. To track medication, use of a tracking sheet such as Glucose Lowering Medication Sheet can be helpful. Refer to [Appendix B](#).

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 (15). Hyperglycemia is a teratogen (16). Some authors encourage continued use of metformin during pregnancy along with insulin, to reduce the dose of insulin, if needed (16, 17). 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.

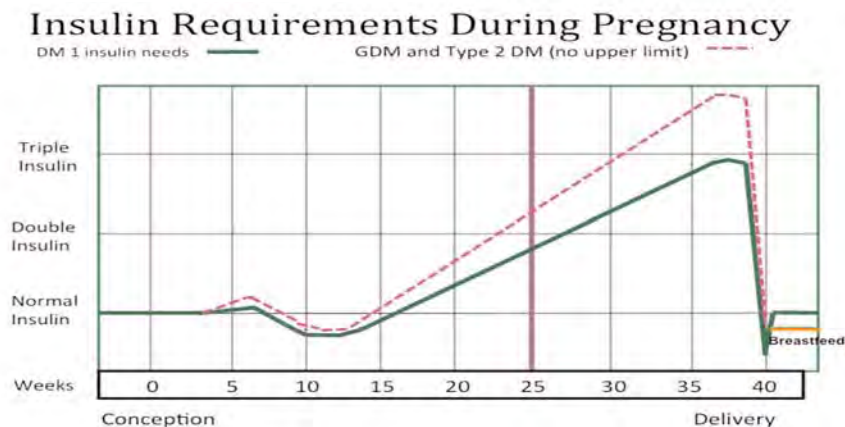
### **Insulin Management with Preexisting Diabetes**

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, with an initial drop at 9 to 16 weeks gestation. From week 17 forward, requirements are expected to rise sequentially until 35 weeks when they level off or decline. For women with PDM, there are wide variations in these changes. For example, women with type 1 diabetes will see significantly low BG during the 9-16 week window unless insulin doses are adjusted downward 10-30% (18). Women with type 2 diabetes may simply have improved BG during this phase. During the second and third trimesters women with type 1 diabetes may see a 60-200% increase in insulin needs, doubling their insulin requirement by term. Women with type 2 diabetes may 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 with preexisting diabetes. The following is a graph of the changes that occur to the insulin requirements during pregnancy. A large copy is available at [Appendix C](#).

Figure 1. (18, 19, 20, 21, 22, 23)



### 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 an onset 4-6 hours and peak of 8-10 hours. NPH is considered helpful for overnight basal and post absorptive needs. 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, stress, etc. 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 are relatively "peakless", and have 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. Bolus insulin make up about 50-60% of the TDD during pregnancy (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). Their action begins 5-15 minutes after injection and peaks at 30-90 minutes. When taken just before the meal, the peak action of analogs is more likely to meet the peak of glucose absorbed from a meal, 50-70 minutes after the first bite of carbohydrate (29). 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.

Both MDI and CSII use the basal-bolus insulin regimens to approximate physiological delivery of insulin during fasting and eating. Tailoring of insulin doses by “daily pattern management” rather than “after-the-fact catch up doses” yields smoother, tighter glycemic control. 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). Use the insulin to carbohydrate ratios (ICR), which is the grams of carbohydrate that will be metabolized by one unit of insulin. This allows the woman to adjust her pre-meal dose of insulin for the anticipated number of carbohydrate grams in the meal. 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 (1).

### **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 or hip, 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,
- ❖ Use Premeal Correction Algorithm found in [Appendix D](#). This algorithm should not be used to correct postmeal elevations.
- ❖ If using basal insulin at bedtime, periodically check 3 AM blood glucose.

[Appendix E-1](#) describes how to calculate insulin doses for Multiple Daily Injection (MDI) for Type 1 and Type 2 diabetes during pregnancy and [Appendix E-2](#) gives an example of how to calculate the formula.

1. Determine the body weight in kilograms:

current weight in pounds divided by 2.2 = (a) \_\_\_ kg.

2. Identify prepregnant BMI

([www.cdc.gov/nccdphp/dnpa/bmi/calc-bmi.htm](http://www.cdc.gov/nccdphp/dnpa/bmi/calc-bmi.htm))

3. Using the table in step 3 of [Appendix E-1](#), determine Total Daily Dose (TDD) of insulin.

The formula is based on patient's weight in kg x Gestational age and Type of diabetes. This provides a small variable amount of insulin by kilogram (b or c). If a patient has Type 1 diabetes and is obese or has uncontrolled GDM, they use the higher formula value under the Type 2 diabetes column.

Calculate total daily dose based on the above formula.

(a) \_\_\_ kg X (b or c) \_\_\_ units per kg = (d) \_\_\_ TDD.

4. TDD will be divided into one half Basal Insulin and one half Bolus Insulin.

5. **Basal Insulin:** Determine basal insulin needs:

$0.5 \times (d) \text{ TDD} = (e) \text{ total daily basal insulin.}$

A. If using long acting analog such as glargine or detemir: divide total daily basal insulin (e) in half and use first half at bedtime (f) and the second half 12 hours later.

B. If using intermediate NPH, use one half basal insulin at bedtime (g) and divide the other half dose into 2-3 doses and administer the basal insulin with the premeal bolus insulin.

6. **Bolus Insulin:** Determine bolus insulin needs.

$0.5 \times (d) \text{ TDD} = (h) \text{ total daily bolus insulin}$

**To administer bolus insulin, either:**

A. Determine INSULIN TO CARBOHYDRATE RATIO (I: CR) (I: CR=Grams of carbohydrate metabolized by 1 unit of insulin) Total daily carbohydrates divided by TDD (d) = I: CR and this number tells you how much insulin to take per gram of carbohydrate. Then estimate how much carbohydrate will be eaten for the meal and

uses this number to determine how much insulin to give prior to the meal,

**OR**

- B. Divide total daily bolus insulin (h) by 7 = fixed pre-meal (i) dose. Multiply fixed pre-meal dose (i) by 3 to get breakfast dose; multiply 2 to get lunch dose and multiply 2 to get dinner dose. (Method B is used if the woman is eating a predetermined or prescribed amount of carbohydrate)

### **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) (32). Continuous subcutaneous insulin infusion (CSII) pump therapy has been initiated during pregnancy without a deterioration of glycemic control with positive maternal and perinatal outcomes. Health care costs are comparable to those among women who were already using pump-CSII before pregnancy or MDI therapy (25). Among 688 Sweet Success clients with type 1 diabetes, 60 (8.7%) were treated with insulin pump-CSII. They had lower mean A1C values compared to those with insulin injections (A1C = 6.7% vs. 7.7%,  $p < 0.001$ ) and were also less likely to undergo cesarean section for macrosomia (33).

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.

**Appendix F-1** describes how to calculate insulin doses for Insulin Pump Continuous Subcutaneous Insulin Infusion (CSII) for Type 1 and Type 2 diabetes during pregnancy, and **Appendix F-2** gives an example of how to calculate the formula (1, 24).

1. Obtain current Total Daily Dose (TDD) of Multiple Daily Injections (MDI), all types of insulin from patient's record = (a) \_\_\_ units/24 hours.
2. Reduce (a) \_\_\_ MDI TDD by 25% to calculate (b) \_\_\_ **reduced pump insulin TDD**.
3. Using the table in step 3 of **Appendix F-1**, determine (e) \_\_\_ **Calculated Total Daily Dose (TDD) of insulin**.

The formula is based on patient's weight in kg, gestational age and type of diabetes. This provides a small variable amount of

insulin by kilogram (c or d). If a patient has Type 1 diabetes and is obese or has uncontrolled GDM, they will use the Type 2 diabetes column.

4. **Final Pump TDD Calculation:**

(b)\_\_\_ Reduced MDI TDD + (e)\_\_\_ Calculated TDD from table in **Appendix F-1** divided by 2 = (f)\_\_\_ Final Pump TDD.

5. **Basal Insulin:** Determine basal insulin needs:

$0.4 \times (f)$ \_\_\_ Final Pump TDD = (g)\_\_\_ total daily pump basal insulin.

6. There are three basal rates:

A. The #3 basal rate (h), is determined by taking (g)\_\_\_ the total daily pump basal insulin divided by 24.

The #3 basal rate (h) is used from 9AM to midnight.

B. The #2 basal rate (i), is determined by multiplying the (h)\_\_\_ #3 basal rate by 1.2.

The #2 basal rate (i) is used from 4 AM to 9AM.

C. The #1 basal rate (j) is determined by multiplying (h)\_\_\_ the #3 basal rate by 0.8.

The #1 basal rate (j) is used from 12 midnight to 4 AM.

7. **Bolus Insulin:** Determine bolus insulin needs:

$0.6 \times (f)$ \_\_\_ Final Pump TDD = (k)\_\_\_ total daily pump bolus insulin.

**INSULIN TO CARBOHYDRATE RATIO (I:CR)**, is the number of grams of carbohydrate that will be metabolized by 1 unit of insulin.

The patient needs to consult with her physician or health care professional to determine the I:CR in order to match the dose of bolus insulin to the amount of carbohydrate eaten to achieve the target level of blood glucose.

For example, use of 400-450 “rule” is based on the assumption that the patient consumes a total of 400-450 grams of carbohydrate daily. The I:CR = 400 divided by (f)\_\_\_ Final Pump TDD. This helps to calculate the grams of carbohydrate that are metabolized by 1 unit of bolus insulin.

8. The Correction Bolus Insulin is also known as Insulin Sensitivity Factor (ISF). As the TDD of insulin increases, the sensitivity of insulin to lower blood glucose decreases.

To calculate the ISF, the patient consults with her physician or health care professional to determine the amount of bolus insulin needed to correct for elevated blood glucose level. In general, use the 1800 “rule”, 1800 divided by (f) the Final Pump TDD, to determine the ISF.

For example, if the patient takes (f) Final Pump TDD of 32 units of insulin, then 1800 divided by 32 (f) Final Pump TDD equals a 56 mg/dl reduction in blood glucose per unit of bolus insulin.

The provider may recommend the “2000 to 2200 rule” for insulin sensitive individuals or the “1200 to 1500 rule” for insulin resistant, Type 2, obese Type 1, or uncontrolled GDM individuals.

**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 is prevented or managed safely. Refer to Table 10 in [Preconception and Interconception Care Chapter \(Ch 2\)](#).

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 6-41% of women with insulin-controlled diabetes and is an expected result of intensive glycemic control (34). The peak incidence of severe hypoglycemia in pregnancy is between 8 to 9 weeks and 15 to 16 weeks gestation. In women with Type 1 diabetes, severe hypoglycemia occurs three to five times more frequently in early pregnancy, whereas in the third trimester the incidence is reduced (21). “Severe” hypoglycemia, is a hypoglycemic state which requires the assistance of another individual, and 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 glucoses 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). Hypoglycemic unawareness can be reversed by several weeks of meticulous avoidance of hypoglycemia (35, 36). Refer to Table 2 for signs and symptoms of hypoglycemia.

<b>Systems affected</b>	<b>Symptoms</b>
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 (33, 38, 39).

Women and their significant others are taught strategies to prevent hypoglycemia during pregnancy and rule of 15 to treat hypoglycemia, including the use of glucagon for the most severe hypoglycemic reactions (loss of consciousness and inability to swallow) (37). Refer to **Appendix H** for strategies to prevent hypoglycemia and the Rule of 15 to treat hypoglycemia. 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 (40, 41):

- ❖ Advanced pregnancy >24 weeks gestation (placental mediated insulin resistance)
- ❖ Obesity BMI  $\geq 30$  (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), Steroids (progesterone, betamethasone, prednisone)

These conditions place a woman with preexisting diabetes at risk for hyperglycemia and potential for ketoacidosis (40). Refer to [Appendix I](#) for an algorithm of changes in insulin dosing during betamethasone treatment (41).

### Sick Days

The goals of sick day care are to:

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

Sick day management is covered in the [Medical Nutrition Therapy Chapter \(Ch 7\)](#).

### 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 9-30%; and the risk of maternal death has been estimated at 4-15% (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. Seventy-eight to ninety percent of cases of DKA occur in the second and third trimester with blood glucose less than 200mg/dL, and necessitates prompt recognition and treatment (4). Predisposing and precipitating factors for DKA are listed in Table 3 below.

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

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.

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 (levels of > 2.0 mmols) have been implicated in effecting fetal neuropsychomotor development (42, 43).
- ❖ Identify and correct the underlying cause of the DKA (5).

Diabetic ketoacidosis in pregnancy is considered a medical emergency and the woman should be treated in a high risk medical unit under the combined care of medicine and obstetrics to reduce the chance of maternal and fetal mortality. (73).

## 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, 26, 44**

<http://www.flu.gov/at-risk/pregnant/>)

Test/Evaluation and Targets	Target 1st Trimester	Target 2nd Trimester	Target 3rd Trimester	Rationale/Risks
<b>Glycemic Control</b>				
<b>Glycemic Control Hemoglobin A1C</b>	A1C >6.5%	A1C >6%	A1C >6%	<ul style="list-style-type: none"> <li>❖ Turnover of red cells in pregnancy is shortened to &lt;90 days.</li> <li>❖ An A1C &lt;6.5% during organogenesis is associated with decreased risk of birth defects and spontaneous abortion (SAB) to the non-diabetic population incidence rate (1-3%).</li> </ul>
<b>Thyroid</b>				
<b>Thyroid Stimulating Hormones (TSH) Thyroid Peroxidase Antibodies (TPO)</b>	<ul style="list-style-type: none"> <li>❖ TSH &gt;0.03 ≤2.5 mIU/mL</li> <li>❖ If normal and not being treated, no further testing</li> </ul>	<ul style="list-style-type: none"> <li>❖ TSH ≤3.5 mIU/mL</li> <li>❖ If normal do not retest</li> <li>❖ Retest if abnormal or being treated</li> </ul>	<ul style="list-style-type: none"> <li>❖ TSH ≤3.5 mIU/mL</li> <li>❖ If normal do not retest</li> <li>❖ Retest if abnormal or being treated</li> </ul>	<ul style="list-style-type: none"> <li>❖ TPO antibodies cross the placenta.</li> <li>❖ Autoimmune thyroid disease is common with type 1 diabetes (35-40%).</li> <li>❖ Abnormal thyroid function can affect fertility and increase risk of spontaneous abortion.</li> <li>❖ Hypothyroid can effect fetal brain development and reduce IQ.</li> <li>❖ Hyperthyroid drug treatment can cause goiter in the fetus. Serial ultrasounds and adjustment of medications will be necessary.</li> </ul>
<b>Lipids</b>				
<b>If insulin resistance, obesity and type 2 diabetes a Fasting Lipid Panel is indicated</b>	<ul style="list-style-type: none"> <li>❖ If indicated</li> <li>LDL ≤100</li> <li>HDL ≥50</li> <li>TGs ≤150</li> </ul>	<ul style="list-style-type: none"> <li>❖ If indicated</li> </ul>	<ul style="list-style-type: none"> <li>❖ If indicated</li> </ul>	<ul style="list-style-type: none"> <li>❖ Lipid abnormalities are associated with <b>insulin resistance, obesity and type 2 diabetes.</b></li> <li>❖ Statin therapy is contraindicated during pregnancy.</li> <li>❖ Triglycerides &gt;500mg. increase risk for pancreatitis and fatty liver disease.</li> </ul>



<b>Table 4. PRENATAL TESTS, EVALUATION AND RATIONALE FOR PREEXISTING DIABETES , Continued (1, 2, 19, 26, 44</b> <a href="http://www.flu.gov/at-risk/pregnant/">http://www.flu.gov/at-risk/pregnant/</a>				
Test/Evaluation and Targets	Target 1st Trimester	Target 2nd Trimester	Target 3rd Trimester	Rationale/Risks
<b>Liver Function</b>				
<b>Aspartate Aminotransferase (AST)</b> <b>Alanine Aminotransferase (ALT)</b>  Assess for history of fatty liver disease with high BMI and poor glucose control.  If liver function tests (LFT) are abnormal consider a liver <b>ultrasound</b>	If indicated Use lab normal	As indicated Use lab normal	As indicated Use lab normal	<ul style="list-style-type: none"> <li>❖ Fatty liver disease has been associated with late term fetal loss.</li> <li>❖ During pregnancy, fatty liver disease is treated with dietary and lifestyle change to improve glycemic control.</li> <li>❖ If aLFT bnormal, consider referral to hepatologist.</li> </ul>
<b>Kidney Function (evaluate for potential Nephropathy)</b>				
Serum Creatinine  <b>Nephropathy:</b> Random urine dip for Microalbumin  Albumin-to-Creatinine Ratio  If at the upper end of normal (25–29 mg) or +1 protein on <b>urine dipstick</b> , obtain a <b>24-hour urine collection</b> for total protein, creatinine clearance with a serum creatinine  <b>Urine C&amp;S</b> if symptomatic for infection	<1  Microalbumin, (≤30 mg is normal)  ACR (<9 mg/mmol)  Urine dipstick for protein at each OB visit  Total protein <300 mg/24 hrs.  Perform as indicated	Repeat if abnormal Urine dipstick for protein at each OB visit  Repeat 24 hour urine collection if abnormal  Perform as needed	Repeat if abnormal Urine dipstick for protein at each OB visit  Repeat 24 hour urine collection if abnormal  Perform as needed	<ul style="list-style-type: none"> <li>❖ Nephropathy is associated with increased risk for early preeclampsia and inter-uterine growth restriction (IUGR).</li> <li>❖ Nephropathy may worsen during pregnancy.</li> <li>❖ Establish baseline renal function.</li> <li>❖ Consider Antibiotic Suppression treatment after one infection.</li> </ul>

<b>Table 4. PRENATAL TESTS, EVALUATION AND RATIONALE FOR PREEXISTING DIABETES , Continued (1, 2, 19, 26, 44</b> <a href="http://www.flu.gov/at-risk/pregnant/">http://www.flu.gov/at-risk/pregnant/</a>				
Test/Evaluation and Targets	Target 1st Trimester	Target 2nd Trimester	Target 3rd Trimester	Rationale/Risks
<b>Hypertension</b>				
<b>Blood Pressure (BP) Evaluation</b> Diabetes is associated with increased incidence of gestational hypertension, preeclampsia, and IUGR  Consider pharmacologic therapy if SBP>140 or DBP>90	Test BP at each office visit  Target 129/79	Test BP at each office visit  Target 129/79	Test BP at each office visit  Target 129/79	<ul style="list-style-type: none"> <li>❖ Uncontrolled hypertension is associated with progression of existing retinopathy, nephropathy, preeclampsia and poor fetal growth -intrauterine growth restriction - (IUGR).</li> <li>❖ Evaluate medications for utilization in pregnancy (refer to the <b>Interconception Chapter (Ch 2)</b>).</li> </ul>
<b>Retinopathy</b>				
<b>Retinal exam</b> by ophthalmologist (dilated retinal exam)	Test	Repeat if abnormal	Repeat if abnormal	<ul style="list-style-type: none"> <li>❖ Poor glycemic control, rapid change in blood glucoses and hypertension are associated with progression of retinopathy.</li> <li>❖ Laser treatment is indicated during pregnancy.</li> <li>❖ If retinopathy is unstable, an assisted delivery with no valsalva maneuvers may be indicated.</li> </ul>
<b>Cardiovascular Disease</b>				
<b>Electrocardiogram (EKG) recommended for:</b> All women with symptoms or significant history; type 2 diabetes; or type1 diabetes for ≥10 years who have not an EKG within the past year	Test and follow-up as indicated			<ul style="list-style-type: none"> <li>❖ 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.</li> <li>❖ If Cardiovascular disease suspected or identified, refer to cardiologist.</li> <li>❖ Associated with both maternal and fetal morbidity and mortality, including poor fetal growth, and preterm and assisted deliveries.</li> </ul>

<b>Table 4. PRENATAL TESTS, EVALUATION AND RATIONALE FOR PREEXISTING DIABETES , Continued (1, 2, 19, 26, 44, <a href="http://www.flu.gov/at-risk/pregnant/">http://www.flu.gov/at-risk/pregnant/</a>)</b>				
Test/Evaluation and Targets	Target 1st Trimester	Target 2nd Trimester	Target 3rd Trimester	Rationale/Risks
<b>Neuropathies</b>				
Neuropathy Assessment and treatment is based on symptoms <ul style="list-style-type: none"> <li>❖ Hypoglycemia awareness</li> <li>❖ Assess foot care</li> </ul>	Check for history of: <ul style="list-style-type: none"> <li>❖ Gastroparesis</li> <li>❖ Orthostatic B/P changes</li> <li>❖ Hypoglycemia unawareness</li> <li>❖ Peripheral pain, burning, weakness</li> </ul>			<ul style="list-style-type: none"> <li>❖ Assess for sensory and autonomic <b>neuropathy</b> as indicated using standard tests.</li> <li>❖ If hypoglycemia unawareness is identified- modified glucose targets may be indicated.</li> <li>❖ Gastroparesis, pain, and infection will effect blood glucose control.</li> </ul>
<b>Other</b>				
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"> <li>❖ 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 <b>medical emergency</b>.</li> <li>❖ Ketoacidosis can develop at lower BG during pregnancy due to accelerated metabolic “starvation”.</li> </ul>
<b>Oral health</b> 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"> <li>❖ Periodontal disease is a chronic oral infection associated with difficult glycemic control, inflammation and pregnancy complications such as preterm labor.</li> <li>❖ Dental treatment is safe during pregnancy.</li> </ul>
<b>Celiac Disease:</b> Antibodies to Tissue Transglutaminase (ATA or Anti-tTG) <b>or</b> Anti-endomysial (EMA) plus Immunoglobulin A (IgA)  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"> <li>❖ Refer to RD for specialized meal plan</li> <li>❖ Do not biopsy</li> </ul>			<ul style="list-style-type: none"> <li>❖ Type 1 diabetes has a 4-12% prevalence of celiac disease compared to 1% in the general population.</li> <li>❖ Celiac disease is an autoimmune disease associated with type 1 diabetes which presents with erratic blood glucose control and mal-absorptive symptoms.</li> </ul>

**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, 21). Refer to the [Neonatal Chapter \(Ch 5\)](#).

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.
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. Repeat if indicated.
28	Umbilical artery Doppler studies	Intrauterine Growth Restriction (IUGR) may be detected by umbilical artery Doppler studies.
32	Antenatal testing (NST/AFI)	Twice weekly or as prescribed for all preexisting diabetes.
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. "The complexity of issues surrounding diabetes, and pregnancy, and the need for excellent glycemic control require that different practitioners provide specific types of care in an integrated manner with the patient at the center of the management team" (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 **Psychosocial Chapter (Ch 9)** 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 plan (1, 43):

- ❖ 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

CDAPP Sweet Success Guidelines for What Women with Preexisting Diabetes can Expect During Labor, Delivery and Postpartum can be found in [Appendix J](#).

### **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 (48).

#### **Timing of Delivery**

Due to a lack of adequate prospective studies, timing of delivery remains controversial. The American Congress of Obstetricians and Gynecologists (ACOG) and the American Diabetes Association (ADA) do not recommend delivery before 39 weeks unless a woman has a clinical indication for preterm delivery (1, 48, 49). Delivery prior to 39 weeks carries a risk of delivering an infant with immature lungs. If delay of delivery is not possible, an amniocentesis to determine fetal lung maturity should be performed. If the lung indices indicate immature fetal lungs or the gestational age is less than 35 weeks, use of betamethasone to help lung maturation is a consideration (6, 49, 50).

#### **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 deliver is not an acceptable clinical practice. With large babies, preeclampsia or labor abnormalities, such as active phase arrest, are more common. Fetal heart rate abnormalities are more common with preeclampsia, vasculopathy and maternal hyperglycemia (1). Continuous fetal heart rate monitoring is recommended (1, 49, 51). Morbid obesity in the mother may preclude monitoring the fetus during labor. The ADA Consensus group states that birth weight at term is strongly dependent on gestational age. They recommend that if the estimated fetal weight (EFW) is 4000-4499 grams and fetal lungs are mature at 37-38 weeks gestation, the decision may be made to induce labor, or deliver by cesarean section at 39 weeks (1, 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 (48). 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 (52). 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 including using forceps or a vacuum device to assist delivery and an increased risk of shoulder dystocia (53). 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 will decrease. Insulin requirements drop by approximately one-third to one-half during the first stage of labor and rise slightly in the second stage (1). The target blood glucose range is 70-110 mg/dL with optimum maintenance of blood glucose at about 100 mg/dL. In a recent study, blood glucose at or above 108 mg/dl within 1 hour before delivery, increased the rate of neonatal hypoglycemia (54, 55). 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.

<b>Table 6. CLINICAL ACTIONS TO MAINTAIN MATERNAL EUGLYCEMIA USING CONTINUOUS INTRAVENOUS INSULIN INFUSION (CIII) - DRIP FOR WOMEN WITH PREEXISTING DIABETES (55, 56)</b>
<b>NOTE:</b> 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. <b>NOTE:</b> 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 devise.
❖ 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

<b>Table 7. CONTINUOUS INTRAVENOUS INSULIN INFUSION (CIII) - DRIP DURING INTRAPARTUM AND POSTPARTUM ALGORITHM (54, 56)</b>		
	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 mr/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 (57). Table 8 lists the general principals of managing CSII-Pump in labor.

<b>Table 8. GENERAL PRINCIPALS OF CONTINUOUS SUBCUTANEOUS INSULIN INFUSION (CSII) - PUMP (25, 57, 58)</b>
❖ 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.

<b>Table 9. TREATING HYPERGLYCEMIA AND HYPOGLYCEMIA WHEN NPO (54, 56, 59)</b>
<b>Note:</b> Hyperglycemia and Hypoglycemia can be avoided by frequent (no less than hourly) blood glucose checks.
<p><b>Treating Hyperglycemia</b> 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 <a href="#">Table 7</a>.</p>
<p><b>Treating Hypoglycemia (Notify physician)</b> If current blood <b>glucose is 50 to 70 mg/dL:</b></p> <ul style="list-style-type: none"> <li>❖ Stop insulin infusion (either Drip-CIII or Pump-CSII).</li> <li>❖ Infuse IV D5 solution at 200 ml/hr.</li> <li>❖ Check blood glucose every 15 min until &gt;70 mg/dL x 2.</li> <li>❖ When blood glucose is 70 mg/dL, restart insulin infusion at a lower algorithm and reduce D5 to 100 ml/hr.</li> </ul> <p>If current blood <b>glucose is less than 50 mg/dL:</b></p> <ul style="list-style-type: none"> <li>❖ STOP insulin infusion (either Drip-CIII or Pump-CSII),</li> <li>❖ Infuse D10 solution at 200 ml/hr,</li> <li>❖ Check blood glucose every 15 min until &gt;70 mg/dL x 2,</li> <li>❖ Carefully consider 10 ml of D50 IV push if BG continues to fall or does not rise above 70 mg/dL in 30 minutes, and</li> <li>❖ When blood glucose is 70 mg/dL, restart insulin infusion at a lower algorithm and reduce D5 to 100 ml/hr.</li> </ul> <p><b>Avoid Glucagon unless the patient is losing consciousness and IV access is lost.</b> 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.</p>

**Cesarean Delivery (1, 25, 47, 51)**

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. 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 (25, 51, 54).

For women with type 2 diabetes, if blood glucose is <100 mg/dL then D5 1/2 NS is started at 100 ml per hour and the blood glucose is checked in 30 minutes. 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 (25, 51).

**Continuous Subcutaneous Insulin Infusion (CSII) (56, 57, 58)**

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 D5 IV solution is started, therefore she may not need an adjustment of her basal insulin until after delivery. Initially postpartum there is 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 is 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 newborn's 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. Perioperative antibiotic prophylaxis is effective in reducing the incidence of postoperative fever, endometritis, and wound infections (60, 61).

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 (DVTs) occurred within the first 6 weeks postpartum. Obesity increases this risk. Studies in non-diabetic women suggest postoperative compression devices provide some preventative benefit (62). Heparin prophylaxis may cause heparin induced thrombocytopenia and major bleeding, therefore it is not recommended (63, 64).

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**POSTPARTUM  
MANAGEMENT OF  
WOMEN WITH  
PREEXISTING  
DIABETES**

Postpartum insulin needs are reduced with the delivery of the placenta. 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 (65, 66).

### **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.

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 (23, 65, 67).
4. Alternately, the woman with type 2 diabetes may use metformin and /or glyburide for blood glucose control at their prepregnant doses. Some women with type 2 diabetes may need no medication for a few days to a week after delivery (68).
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).
6. Blood glucose is checked frequently in the first few days postpartum as insulin needs rapidly change especially with breastfeeding (refer to **Breastfeeding Chapter (Ch 8)**)

- 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 **Breastfeeding Chapter (Ch 8)**
- Check blood glucose 3 AM, fasting, before meals, two hours after meals, and at bedtime

### **Glycemic Control after Cesarean Birth (20, 23, 65)**

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 **Breastfeeding Chapter (Ch 8)**).
    - 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 **Breastfeeding Chapter (Ch 8)**)
    - Check blood glucose 3 AM, fasting, before meals, and one to two hours after meals, and at bedtime.

**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 (66). Maximizing BG control during the interconception period is a priority. Delaying pregnancy more than 18 months during this transition period is recommended. A meta-analysis of Birth Spacing and Adverse Perinatal Outcomes concluded that Interpregnancy intervals shorter than 18 months are significantly associated with increased risk of adverse perinatal outcomes (69). Select the most effective method of birth control with the least adverse effect on carbohydrate metabolism. Refer to the [Appendix K](#) for Contraception for Women with Diabetes Mellitus.

Table 10, which follows, addresses recommendations for post partum self-care and follow-up for women with preexisting diabetes.

<b>Self Management Behavior</b>	<b>Goal</b>	<b>Rationale</b>
Healthy Eating	<ul style="list-style-type: none"> <li>• Postpartum follow up at 2-6 weeks with RD to reinforce a meal plan that incorporates principals of healthy meal and lifestyle.</li> <li>• Encourage attainment of a healthy BMI.</li> <li>• Adjust meal plan as needed to accommodate breastfeeding needs and weight goals.</li> <li>• Women with celiac disease can be deficient in iron, fat soluble vitamins, B12 and folate.</li> </ul>	<p>Refer to <a href="#">Nutrition Chapter</a> for specific suggestions for postpartum meal plan recommendations.</p> <p>Refer to <a href="#">Breastfeeding Chapter</a> and <a href="#">Appendix L</a>, Nutrition Tips for Women Who Breastfeed and Take Insulin.</p>
Staying Active	<ul style="list-style-type: none"> <li>• With medical approval, encourage 30-60 minutes per day, everyday, of brisk activity, such as walking, swimming stationary cycling etc. Find an ongoing, long term, enjoyable activity program.</li> </ul>	<p>Refer to <a href="#">Exercise Chapter</a></p> <p>Exercise increases insulin sensitivity and may decrease postpartum mood disorders.</p>
Monitoring Blood Glucose	<ul style="list-style-type: none"> <li>• Maintain blood glucose within these targets for postpartum and while breastfeeding:               <ul style="list-style-type: none"> <li>◦ Fasting/premeal &lt;110mg/dL</li> <li>◦ 2 hour postmeal &lt;150 -170mg/dL</li> </ul> </li> <li>• Target if not breastfeeding:               <ul style="list-style-type: none"> <li>◦ Fasting/premeal &lt;120mg/dL</li> <li>◦ 2 hour postmeal &lt;180mg/dL</li> </ul> </li> <li>• Once blood glucose and medication management are stabilized, check blood glucose fasting, before meals and at bedtime. Post meal testing as indicated.</li> </ul>	<p>Checking blood glucose 3-7 times per day is associated with improved glucose control and fewer complications of diabetes. Strive for A1C of &lt;7% at 3 months postpartum.</p>

**Table 10. POSTPARTUM SELF CARE AND FOLLOW-UP FOR WOMEN WITH PREEXISTING DIABETES** Continued (1, 66, 68, 70, 71, 72)

Self Management Behavior	Goal	Rationale
Taking Medications	<ul style="list-style-type: none"> <li>• Maintain contact with provider throughout the first 6 weeks postpartum as insulin or oral hypoglycemic medication needs drop or change frequently.</li> <li>• Metformin and glyburide are considered safe for breastfeeding.</li> <li>• Women who utilized antihypertensive therapy or lipid lowering medication, should consult with their physician regarding the medication and breastfeeding.</li> </ul>	<p>Refer to <a href="#">Appendices E1, E2, F1 and F2</a> to calculate Total Daily Dose of insulin by MDI or pump.</p> <p>Refer to <a href="#">Breastfeeding Chapter</a>.</p>
Problem Solving	<ul style="list-style-type: none"> <li>• 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.</li> <li>• Although CDAPP Sweet Success Affiliates may provide diabetes care until 6 weeks postpartum, a primary care provider should be available for emergencies.</li> </ul>	<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>
Reducing Risks	<ul style="list-style-type: none"> <li>• Continue normal diabetic care. Obtain A1C, lipids and TSH at 6 months postpartum or sooner if indicated.</li> <li>• Target values:               <ul style="list-style-type: none"> <li>o A1C &lt;7%</li> <li>o LDL &lt;100mg/dL</li> <li>o HDL &gt;50 mg/dL</li> <li>o TGs &lt;150mg/dL</li> </ul> </li> <li>• Breastfeed for at least 6 months, preferably for 1 year.</li> <li>• Plan future pregnancies:               <ul style="list-style-type: none"> <li>o Postpartum begins preconception for future pregnancies.</li> <li>o Plan for adequate birth control.</li> </ul> </li> </ul>	<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.</p> <p>Refer to <a href="#">Appendix A in the Preconception Care Chapter</a>.</p>
Healthy coping	<ul style="list-style-type: none"> <li>• Encourage use of family and social support system (mothers groups etc.).</li> <li>• Assess ability to provide care for self and infant.</li> <li>• Assess with Edinburgh Postnatal Depression Scale at 6 weeks postpartum and again at 3 months postpartum.</li> </ul>	<p>The nature of perinatal mood and anxiety disorders (PMAD) require providers to be able to identify, educate the family, and make appropriate referrals.</p> <p>Refer to <a href="#">Psychosocial Chapter</a>.</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 Glucose Lowering Medication Sheet
- C Changes in Insulin Requirements During Pregnancy
- D Suggested Premeal Insulin Correction Algorithm for Patients Using MDI
- E-1 Calculating Insulin Doses by Multiple Daily Injections (MDI) for Type 1 and Type 2 Diabetes During Pregnancy
- E-2 Example of use: Calculating Insulin Doses for Multiple Daily Injections (MDI) for Type 1 and Type 2 Diabetes During Pregnancy
- F-1 Calculations for Insulin Pump Continuous Subcutaneous Insulin Infusion (CSII) during Pregnancy
- F-2 Example of use: Calculations for Insulin Pump Continuous Subcutaneous Insulin Infusion (CSII) during Pregnancy
- G Body Mass Index Table
- H Strategies to Prevent Hypoglycemia and Rule of 15 to Treat Hypoglycemia
- I Insulin Adjustments During Bethamethasone Use Algorithm
- J CDAPP Sweet Success Guidelines for What Women with Preexisting Diabetes Can Expect During Labor, Delivery and Postpartum
- K Contraception Options for Women with Diabetes Mellitus
- L Brochure: Nutrition Tips for Women who Breastfeed and Take Insulin

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**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.

<b>RISK FOR MAJOR OR MINOR CONGENITAL ANOMALY BASED ON PERICONCEPTIONAL A1C *(1)</b>													
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

\*1. Guerin A, Nisenbaum R, Ray JG. Use of maternal Ghb concentration to estimate the risk of congenital anomalies in the offspring of women with prepregnancy diabetes. *Diabetes Care* 2007;30:1920-1925.

Multiple factors can change the A1C results. The table below is a partial list of factors that are often encountered.

<b>FACTORS THAT IMPACT BLOOD GLUCOSE LEVELS AND A1C BEFORE AND DURING PREGNANCY *(2, 3, 4)</b>		
<b>FACTOR</b>	<b>Increased BG/A1C</b>	<b>Decreased BG/A1C</b>
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	

\*2. Little RR, Roberts WL. A review of variant hemoglobins interfering with hemoglobin A1c measurement. *J of Diabetes Science and technology* 2009;3(3):446-451.

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**Appendix B**

**Glucose Lowering Medication Sheet**

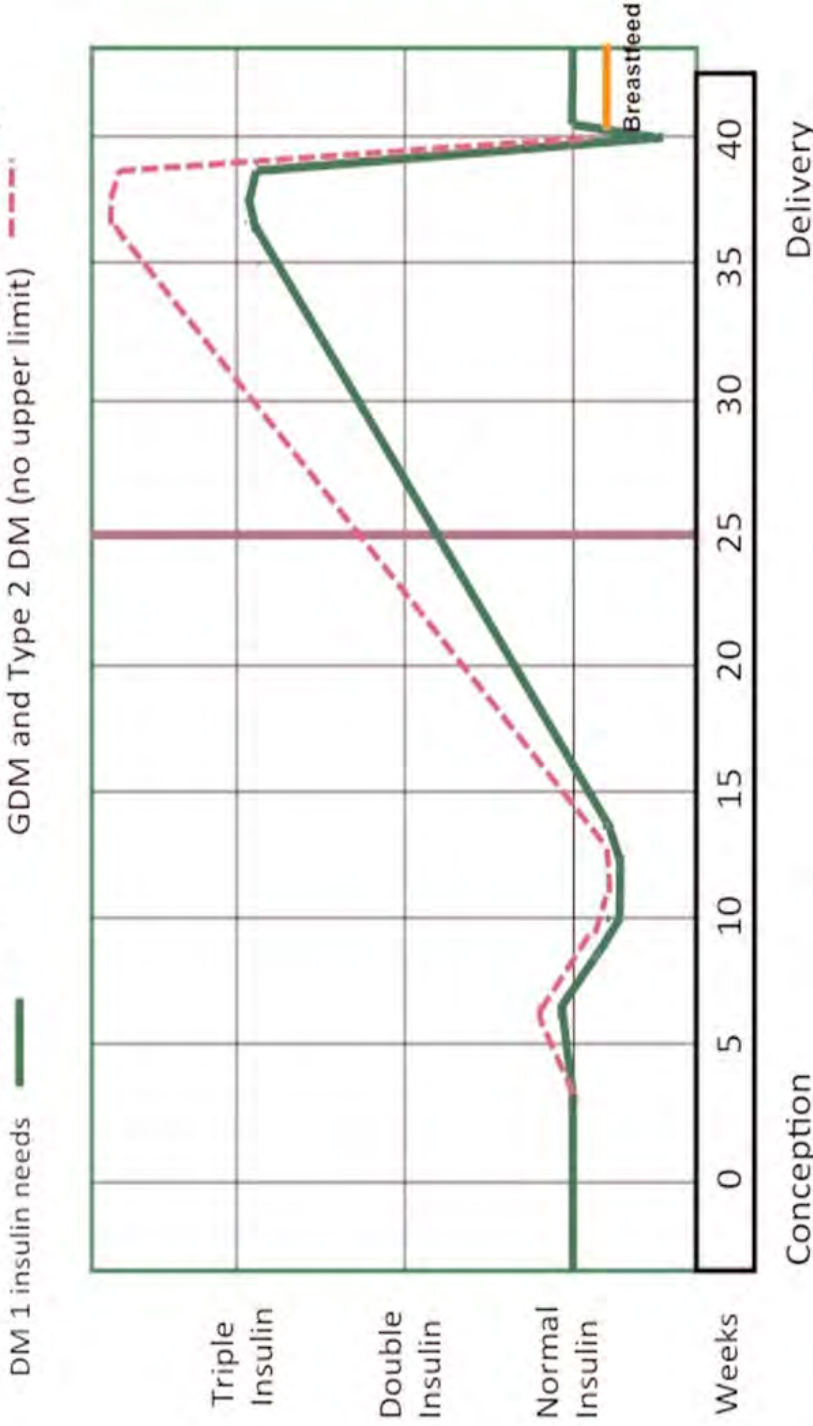
Patient's Name						DOB	
<input type="checkbox"/> Humulin NPH (HN)		<input type="checkbox"/> Novolin NPH (NN)		<input type="checkbox"/> Vial		<input type="checkbox"/> Pen	
<input type="checkbox"/> Humalog (Lispro)		<input type="checkbox"/> Novolog (Aspart)		<input type="checkbox"/> Vial		<input type="checkbox"/> Pen	
<input type="checkbox"/> Metformin/Glucofage (Met)		<input type="checkbox"/> Glyburide (Glyb)					
Other							
Date	Medication	Breakfast	Lunch	Dinner	Bedtime	Other	Initials
Initials	Provider Signature						



Appendix C

Changes in Insulin Requirements During Pregnancy

# Insulin Requirements During Pregnancy



1. Garcia-Patterson A, Gich I, Amini SB, et al. Insulin requirements throughout pregnancy in women with type 1 diabetes mellitus: three changes of direction. *Diabetologia* 2010;53:446-451.
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7. Rivielo C, Mello G, Jovanovic LG. Breastfeeding and the basal insulin requirement in type 1 diabetic women. *Endocr Pract.* 2009;15:187-193.

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

<b>SUGGESTED PREMEAL INSULIN CORRECTION ALGORITHM - MDI</b>		
<b>If BG before meals (breakfast , lunch and dinner) is:</b>	<b>Supplement the dose of premeal rapid acting analog by taking:</b>	<b>And</b>
< 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. Again this algorithm must be modified to individual needs and used before meals for patients using MDI.		

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**

**Appendix E-1**

**CALCULATING INSULIN DOSES  
for Multiple Daily Injections (MDI) for Type 1 and Type 2 Diabetes  
During Pregnancy**

1. Calculate body weight in kilograms <b>Current weight in pounds divided by 2.2 = (a)</b>	(a) ____ kg																					
2. Identify prepregnant BMI category (using Appendix G, Body Mass Index Table, or the link: <a href="http://www.cdc.gov/healthyweight/assessing/bmi/index.html">http://www.cdc.gov/healthyweight/assessing/bmi/index.html</a> )	____ BMI																					
3. Determine units/kg of insulin required using table below starting with the patient's gestational age. Then use Type 1 column they have type 1 diabetes <b>(b)</b> <b>OR</b> Use Type 2 column if they have type2 diabetes or type 1 diabetes with a BMI >30 or if the patient has uncontrolled GDM <b>(c)</b> .	(b) ____ units/kg <b>OR</b> (c) ____ units/kg																					
<table border="1"> <thead> <tr> <th>Gestational age</th> <th>Type 1</th> <th>Type 2/ obese Type 1, uncontrolled GDM</th> </tr> </thead> <tbody> <tr> <td>Pre pregnant</td> <td>0.4-0.55 units/kg</td> <td>0.5-0.7 units/kg</td> </tr> <tr> <td>Week 1–17</td> <td>0.3-0.5 units/kg</td> <td>0.7-0.8 units/kg</td> </tr> <tr> <td>Week 18–24</td> <td>0.6-0.7 units/kg</td> <td>0.8-1.0 units/kg</td> </tr> <tr> <td>Week 25–32</td> <td>0.8-0.9 units/kg</td> <td>0.9-1.2 units/kg</td> </tr> <tr> <td>Week 33–38</td> <td>0.9-1.0 units/kg</td> <td>1.2-2.0 units/kg</td> </tr> <tr> <td>Post partum</td> <td>0.3-0.5 units/kg</td> <td>0.5-0.7 units/kg</td> </tr> </tbody> </table>		Gestational age	Type 1	Type 2/ obese Type 1, uncontrolled GDM	Pre pregnant	0.4-0.55 units/kg	0.5-0.7 units/kg	Week 1–17	0.3-0.5 units/kg	0.7-0.8 units/kg	Week 18–24	0.6-0.7 units/kg	0.8-1.0 units/kg	Week 25–32	0.8-0.9 units/kg	0.9-1.2 units/kg	Week 33–38	0.9-1.0 units/kg	1.2-2.0 units/kg	Post partum	0.3-0.5 units/kg	0.5-0.7 units/kg
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Week 33–38	0.9-1.0 units/kg	1.2-2.0 units/kg																				
Post partum	0.3-0.5 units/kg	0.5-0.7 units/kg																				
4. Calculate Total Daily Dose (TDD): <b>Patient's weight in kg (a) X (b) OR (c) ____ units /kg = (d)</b>	(d) ____ units																					
5. Calculate BASAL INSULIN Dose <b>TDD (d) X 0.5 = total daily basal insulin (e)</b> Then adjust total basal insulin dose <b>(e)</b> by Method A or B depending on type of insulin used: A. If using long acting analog such as glargine or detemir: Divide total daily basal insulin <b>(e)</b> in half and give one half at bedtime <b>(f)</b> and the second half 12 hours later. <b>Total daily basal insulin (e) divided by 2 = ____ units/at bedtime (f) &amp; ____ units to 12 hrs later</b> <b>OR</b> B. If using intermediate NPH, use one half total daily basal insulin <b>(e)</b> at bedtime and divide the other half dose into 2- 3 doses of basal insulin and administer with premeal bolus insulin. <b>Total daily NPH insulin (e) divided by 2 = ____ units/at bedtime (g)</b>  The second half dose of <b>(e)</b> divided into 2 or 3 and give with pre-meal insulin bolus described in Step 6 below	(e) ____ units (f) ____ units at bedtime & ____ units 12 hrs later (g) ____ units at Bedtime Second half dose of NPH divided into 2-3 doses ____ basal units with pre-meal bolus																					
6. Calculate Pre-Meal Bolus Insulin Dose <b>TDD (d) X 0.5 = ____ total daily bolus insulin (h)</b> Calculate Bolus Insulin Doses by Method A or B: A. Determine INSULIN TO CARBOHYDRATE RATIO (I: CR) (I: CR=Grams of carbohydrate metabolized by 1 unit of insulin). <b>Total daily carbohydrates divided by TDD (d) = I:CR</b> and this number tells you how much insulin to take per gram of carbohydrate. Then estimate how much carbohydrate will be eaten for the meal and uses this number to determine how much insulin to give prior to the meal. The patient needs to consult with her physician or health care professional to determine the I:CR. <b>OR</b> B. <b>Divide total daily bolus insulin (h) by 7 = fixed pre-meal (i) dose.</b> Multiply fixed pre-meal dose <b>(i)</b> by 3 to get breakfast dose; multiply by 2 to get lunch dose and multiply by 2 to get dinner dose. (Method B is used if the woman is eating a predetermined or prescribed amount of carbohydrate)	Total daily bolus (h) ____ units ____ I:CR ratio (i) ____ units B: ____ units L: ____ units D: ____ units																					

Reference: Kitzmiller, Jovanovic L, Brown F, et al, editors. Managing Preexisting Diabetes and pregnancy: technical reviews and consensus recommendations for care. Alexandria(VA): American Diabetes Association; 2008.p.89-96.

Appendix E-2

**EXAMPLE OF CALCULATING INSULIN DOSES  
for Multiple Daily Injections (MDI) for Type 1 and Type 2  
Diabetes During Pregnancy**

Example for woman 144 lbs, BMI 23.5, 10 weeks gestation, Type 1 Diabetes

1. Calculate body weight in kilograms: Current weight in pounds ( <b>144 lbs</b> ) divided by 2.2 = <b>(a) 65</b>	(a) <b>65</b> kg																					
2. Identify prepregnant BMI category (using Appendix G, Body Mass Index Table, or the link: <a href="http://www.cdc.gov/healthyweight/assessing/bmi/index.html">http://www.cdc.gov/healthyweight/assessing/bmi/index.html</a> )	<b>23.5</b> BMI																					
3. Determine units/kg of insulin required using table below starting with the patient's gestational age. Then use Type 1 column they have type 1 diabetes <b>(b) = 0.5 units/kg</b> <b>OR</b> Use Type 2 column if they have type2 diabetes or type 1 diabetes with a BMI >30 or if the patient has uncontrolled GDM <b>(c)</b> .	(b) <b>0.5</b> units/kg <b>OR</b> (c) ____ units/kg																					
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4. Calculate Total Daily Dose (TDD): Pt's weight in kg <b>(a) 65</b> X <b>(b) 0.5</b> OR <b>(c) ____</b> units/kg = <b>(d) 32</b>	(d) <b>32</b> units																					
5. Calculate BASAL INSULIN Dose TDD <b>(d) 32</b> X 0.5 = <b>16</b> total daily basal insulin <b>(e)</b> Then adjust total basal insulin dose <b>(e)</b> by Method A or B depending on type of insulin used: A. If using long acting analog such as glargine or detemir: Divide total daily basal insulin <b>(e)</b> in half and give one half at bedtime <b>(f)</b> and the second half 12 hours later. Total daily basal insulin <b>(e) 16</b> divided by 2 = <b>8</b> units/at bedtime <b>(f) &amp; 8</b> units to 12 hrs later <b>OR</b> B. If using intermediate NPH, use one half total daily basal insulin <b>(e)</b> at bedtime and divide the other half dose into 2- 3 doses of basal insulin and administer with premeal bolus insulin. Total daily NPH insulin <b>(e) 16</b> divided by 2 = <b>8</b> units/at bedtime <b>(g)</b>  The second half dose of <b>(e)</b> divided into 2 or 3 and give with pre-meal insulin bolus described in Step 6 below	(e) <b>16</b> units (f) <b>8</b> units at bedtime & <b>8</b> units 12 hrs later (g) <b>8</b> units at Bedtime Second half dose of NPH divided into 2-3 doses ____ basal units with pre-meal bolus																					
6. Calculate Pre-Meal Bolus Insulin Dose TDD <b>(d) 32</b> X 0.5 = <b>16</b> total daily bolus insulin <b>(h)</b> Calculate Bolus Insulin Doses by Method A or B: A. Determine INSULIN TO CARBOHYDRATE RATIO (I: CR) (I: CR=Grams of carbohydrate metabolized by 1 unit of insulin). <b>Total daily carbohydrates divided by TDD (d) = I:CR</b> and this number tells you how much insulin to take per gram of carbohydrate. Then estimate how much carbohydrate will be eaten for the meal and uses this number to determine how much insulin to give prior to the meal. The patient needs to consult with her physician or health care professional to determine the I:CR. <b>OR</b> B. <b>Divide total daily bolus insulin (h) by 7 = fixed pre-meal (i) dose.</b> Multiply fixed pre-meal dose <b>(i)</b> by 3 to get breakfast dose; multiply by 2 to get lunch dose and multiply by 2 to get dinner dose. (Method B is used if the woman is eating a predetermined or prescribed amount of carbohydrate)	Total daily bolus <b>(h) 16</b> units ____ I:CR ratio (i) ____ units B: ____ units L: ____ units D: ____ units																					

Reference: Kitzmiller, Jovanovic L, Brown F, et al, editors. Managing Preexisting Diabetes and pregnancy: technical reviews and consensus recommendations for care. Alexandria(VA): American Diabetes Association; 2008.p.89-96.

Appendix F-1

**Calculations for Insulin Pump Continuous Subcutaneous Insulin Infusion (CSII) During Pregnancy**

<b>To initiate CSII from Multiple Daily Injections of Insulin (MDI)</b>		
1	Determine Total Daily Dose (TDD) by totaling all types of insulin (MDI) from pt. records = units/24 hours <b>(a)</b>	<b>(a) ___ units</b>
2	Calculate Reduced Pump TDD by reducing MDI TDD by 25%: <b>TDD of MDI (a) x 0.75 = Reduced Pump TDD (b)</b>	<b>(b) ___ units</b>
3	Identify pre-pregnant BMI category. Use patient height and weight to determine BMI. Refer to Appendix G, Body Mass Index Table, or use the link: <a href="http://www.cdc.gov/nccdphp/dnpa/bmi/calc-bmi.htm">www.cdc.gov/nccdphp/dnpa/bmi/calc-bmi.htm</a>	<b>___ BMI</b>
4	Determine units/kg or insulin required using the table below starting with the patient's gestational age. Then use Type 1 column if they have type 1 diabetes <b>(c)</b> <b>OR</b> Use Type 2 column if they have Type 2 diabetes, or Type 1 Diabetes with a BMI >30, or if the patient has uncontrolled GDM <b>(d)</b> .	<b>(c) ___ units</b>  <b>or</b> <b>(d) ___ units</b>
		<b>Obese Type 1, Type 2, or uncontrolled GDM</b>
<b>Gestational age</b>	<b>Type 1</b>	
Pre pregnant	0.4-0.55 units/kg	0.5-0.7 units/kg
Week 1– 17	0.3-0.5 units/kg	0.7-0.8 units/kg
Week 18–24	0.6-0.7 units/kg	0.8-1.0 units/kg
Week 25–32	0.8-0.9 units/kg	0.9-1.2 units/kg
Week 33–38	0.9-1.0 units/kg	1.2-2.0 units/kg
Post partum	0.3-0.5 units/kg	0.5-0.7 units/kg
5	Determine the Calculated TDD: Patient's weight in kg X <b>(c)</b> or <b>(d)</b> = Calculated TDD <b>(e)</b>	<b>(e) ___ units</b>
6	Calculate Final Pump TDD: Reduced Pump TDD <b>(b)</b> + Calculated TDD <b>(e)</b> divided by 2 = Final Pump TDD <b>(f)</b>	<b>(f) ___ units</b>
7	<b>Calculate Total Daily Basal Insulin Dose:</b> use 40% of final pump TDD Final Pump TDD <b>(f)</b> x 0.4 = Total Daily Basal Insulin Dose <b>(g)</b> <b>Note:</b> Less basal insulin is needed than bolus insulin	<b>(g) ___ units</b>
8	Determine Basal Rates # 3, #2, and #1 Follow steps A - C. A. Total daily basal insulin <b>(g)</b> ÷ 24 = This is #3 Basal Rate <b>(h)</b> per hour from ___ to ___ (From awakening or 1 hr. after awakening to midnight, approximately 15-16 hrs. duration) B. #3 Basal Rate <b>(h)</b> X 1.2 = This is #2 Basal Rate <b>(i)</b> per hour from ___ to ___ (From 3 hrs before awakening to 1 hr. after awakening, 4- 5 hrs, duration) C. #3 Basal Rate <b>(h)</b> X 0.8 = This is #1 Basal Rate <b>(j)</b> per hour from ___ to ___ (From midnight to 3 hrs. before awakening, approximately 4 hrs, duration)	<b>(h) ___ units</b> <b>(i) ___ units</b> <b>(j) ___ units</b>
9	<b>Calculate Total Daily Bolus Insulin Dose:</b> Final Pump TDD <b>(f)</b> x 0.6 = ___ Total Daily Bolus Insulin Dose <b>(k)</b> <b>OR</b> use Insulin to Carbohydrate ratio (I: CR) to determine Bolus Insulin Dose. <b>INSULIN TO CARBOHYDRATE RATIO (I: CR)</b> (I: CR = Grams of carbohydrate metabolized by 1 unit of insulin). Total daily carbohydrates divided by Final Pump TDD <b>(f)</b> = I: CR <b>(l)</b> and this number tells you how much insulin to take per gram of carbohydrate. Then estimate how much carbohydrate will be eaten for the meal and uses this number to determine how much insulin to give. The patient needs to consult with her physician or health care professional to determine the I: CR. For example, Use of 400-450 "rule" is based on the consumption of 400-450 grams of carbohydrate daily. 400 ÷ Final Pump TDD <b>(f)</b> = I:CR	<b>(k) ___ units</b>  <b>(l) ___ I:CR</b>
	<b>CORRECTION Bolus</b> AKA Insulin Sensitivity Factor. To calculate the ISF, the patient consults with her physician or health care professional to determine the amount of bolus insulin needed to correct for elevated blood glucose level. In general, use the "1800 rule", 1800 divided by the Final Pump TDD <b>(f)</b> , to determine the ISF. <b>1800 ÷ Final Pump TDD (f) = ISF (m)</b> For example if the patient takes a Final Pump TDD of 32 units of insulin, then 1800 divided by 32 (Final Pump TDD) equals a 56 mg/dl <b>(m)</b> reduction in blood glucose per unit of bolus insulin. The provider may recommend the "2000 to 2200 rule" for insulin sensitive individuals or the "1200 to 1500 rule" for insulin resistant, Type 2, obese Type 1, or uncontrolled GDM individuals.	<b>(m) ___ ISF</b>

Reference: Kitzmiller, Jovanovic L, Brown F, et al, editors. Managing Preexisting Diabetes and pregnancy: technical reviews and consensus recommendations for care. Alexandria(VA): American Diabetes Association; 2008.p.89-96.

Appendix F-2

**Example of Calculations for Insulin Pump Continuous Subcutaneous Insulin Infusion (CSII) During Pregnancy**  
**Example for woman 144 lbs, BMI 23.5, 10 weeks gestation, Type 1**

<b>To initiate CSII from Multiple Daily Injections of Insulin (MDI)</b>		
1	Determine Total Daily Dose (TDD) by totaling all types of insulin (MDI) from pt. records = units/24 hours <b>(a)</b>	(a) <b>43</b> units
2	Calculate Reduced Pump TDD by reducing MDI TDD by 25%: TDD of MDI <b>(a) 43</b> x 0.75 = Reduced Pump TDD <b>(b) 32</b>	(b) <b>32</b> units
3	Identify pre-pregnant BMI category. Use patient height and weight to determine BMI. Refer to Appendix G, Body Mass Index Table, or use the link: <a href="http://www.cdc.gov/nccdphp/dnpa/bmi/calc-bmi.htm">www.cdc.gov/nccdphp/dnpa/bmi/calc-bmi.htm</a>	<b>23.5</b> BMI
4	Determine units/kg or insulin required using the table below starting with the patient's gestational age. Then use Type 1 column if they have type 1 diabetes <b>(c) 0.5</b> <b>OR</b> Use Type 2 column if they have Type 2 diabetes, or Type 1 Diabetes with a BMI >30, or if the patient has uncontrolled GDM <b>(d)</b> .	(c) <b>0.5</b> units or (d) ____ units
<b>Gestational age</b>		
<b>Type 1</b>		<b>Obese Type 1, Type 2, or uncontrolled GDM</b>
Pre pregnant	0.4-0.55 units/kg	0.5-0.7 units/kg
<b>Week 1– 17</b>	<b>0.3-0.5 units/kg</b>	0.7-0.8 units/kg
Week 18–24	0.6-0.7 units/kg	0.8-1.0 units/kg
Week 25–32	0.8-0.9 units/kg	0.9-1.2 units/kg
Week 33–38	0.9-1.0 units/kg	1.2-2.0 units/kg
Post partum	0.3-0.5 units/kg	0.5-0.7 units/kg
5	Determine the Calculated <b>TDD</b> : Patient's weight in kg <b>65</b> X <b>(c) 0.5</b> or <b>(d)</b> = Calculated TDD <b>(e) 32</b>	(e) <b>32</b> units
6	Calculate Final Pump TDD: Reduced Pump TDD <b>(b) 32</b> + Calculated TDD <b>(e) 32</b> divided by 2 = Final Pump TDD <b>(f) 32</b>	(f) <b>32</b> units
7	<b>Calculate Total Daily Basal Insulin Dose:</b> use 40% of final pump TDD Final Pump TDD <b>(f) 32</b> x 0.4 = Total Daily Basal Insulin Dose <b>(g) 12.8</b> <b>Note:</b> Less basal insulin is needed than bolus insulin	(g) <b>12.8</b> units
8	Determine Basal Rates # 3, #2, and #1 Follow steps A - C. A. Total daily basal insulin <b>(g) 12.8</b> ÷ 24 = <b>0.53</b> This is #3 Basal Rate <b>(h)</b> per hour from ____ to ____ (From awakening or 1 hr. after awakening to midnight, approximately 15-16 hrs. duration) B. #3 Basal Rate <b>(h) 0.53</b> X 1.2 = <b>0.64</b> This is #2 Basal Rate <b>(i)</b> per hour from ____ to ____ (From 3 hrs before awakening to 1 hr. after awakening, 4- 5 hrs, duration) C. #3 Basal Rate <b>(h) 0.53</b> X 0.8 = <b>0.42</b> This is #1 Basal Rate <b>(j)</b> per hour from ____ to ____ (From midnight to 3 hrs. before awakening, approximately 4 hrs, duration)	(h) <b>0.53</b> units (i) <b>0.64</b> units (j) <b>0.42</b> units
9	<b>Calculate Total Daily Bolus Insulin Dose:</b> Final Pump TDD <b>(f) 32</b> x 0.6 = <b>19.2</b> Total Daily Bolus Insulin Dose <b>(k)</b> <b>OR</b> use Insulin to Carbohydrate ratio (I: CR) to determine Bolus Insulin Dose. <b>INSULIN TO CARBOHYDRATE RATIO (I: CR)</b> (I: CR = Grams of carbohydrate metabolized by 1 unit of insulin). Total daily carbohydrates divided by Final Pump TDD <b>(f)</b> = I: CR <b>(l)</b> and this number tells you how much insulin to take per gram of carbohydrate. Then estimate how much carbohydrate will be eaten for the meal and uses this number to determine how much insulin to give. The patient needs to consult with her physician or health care professional to determine the I: CR. For example, Use of 400-450 "rule" is based on the consumption of 400-450 grams of carbohydrate daily. 400 ÷ Final Pump TDD <b>(f) 32</b> = <b>1:12</b> I:CR	(k) <b>19.2</b> units          (l) <b>1:12</b> I:CR
	<b>CORRECTION Bolus</b> AKA Insulin Sensitivity Factor. To calculate the ISF, the patient consults with her physician or health care professional to determine the amount of bolus insulin needed to correct for elevated blood glucose level. In general, use the "1800 rule", 1800 divided by the Final Pump TDD <b>(f)</b> , to determine the ISF. <b>1800 ÷ Final Pump TDD (f) 32 = ISF (m) 56</b> For example if the patient takes a Final Pump TDD of 32 units of insulin, then 1800 divided by 32 (Final Pump TDD) equals a 56 mg/dl <b>(m)</b> reduction in blood glucose per unit of bolus insulin. The provider may recommend the "2000 to 2200 rule" for insulin sensitive individuals or the "1200 to 1500 rule" for insulin resistant, Type 2, obese Type 1, or uncontrolled GDM individuals.	(m) <b>56</b> ISF

Reference: Kitzmiller, Jovanovic L, Brown F, et al, editors. Managing Preexisting Diabetes and pregnancy: technical reviews and consensus recommendations for care. Alexandria(VA): American Diabetes Association; 2008.p.89-96.

Appendix G

Body Mass Index Table

BMI	Normal										Overweight										Obese										Extreme Obesity																							
	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54																		
Height Inches																																																						
58	91	96	100	105	110	115	119	124	129	134	138	143	148	153	158	162	167	172	177	181	186	191	196	201	205	210	215	220	224	229	234	239	244	248	253	258																		
59	94	99	104	109	114	119	124	128	133	138	143	148	153	158	163	168	173	178	183	188	193	198	203	208	212	217	222	227	232	237	242	247	252	257	262	267																		
60	97	102	107	112	118	123	128	133	138	143	148	153	158	163	168	174	179	184	189	194	199	204	209	215	220	225	230	235	240	245	250	255	261	266	271	276																		
61	100	106	111	116	122	127	132	137	143	148	153	158	164	169	174	180	185	190	195	201	206	211	217	222	227	232	238	243	248	254	259	264	269	275	280	285																		
62	104	109	115	120	126	131	136	142	147	153	158	164	169	175	180	186	191	196	202	207	213	218	224	229	235	240	246	251	256	262	267	273	278	284	289	295																		
63	107	113	118	124	130	135	141	146	152	158	163	169	175	180	186	191	197	203	208	214	220	225	231	237	242	248	254	259	265	270	278	282	287	293	299	304																		
64	110	116	122	128	134	140	145	151	157	163	169	174	180	186	192	197	204	209	215	221	227	232	238	244	250	256	262	267	273	279	285	291	296	302	308	314																		
65	114	120	126	132	138	144	150	156	162	168	174	180	186	192	198	204	210	216	222	228	234	240	246	252	258	264	270	276	282	288	294	300	306	312	318	324																		
66	118	124	130	136	142	148	155	161	167	173	179	186	192	198	204	210	216	223	229	235	241	247	253	260	266	272	278	284	291	297	303	309	315	322	328	334																		
67	121	127	134	140	146	153	159	166	172	178	185	191	198	204	211	217	223	230	236	242	249	255	261	268	274	280	287	293	299	306	312	319	325	331	338	344																		
68	125	131	138	144	151	158	164	171	177	184	190	197	203	210	216	223	230	236	243	249	256	262	269	276	282	289	295	302	308	315	322	328	335	341	348	354																		
69	128	135	142	149	155	162	169	176	182	189	196	203	209	216	223	230	236	243	250	257	263	270	277	284	291	297	304	311	318	324	331	338	345	351	358	365																		
70	132	139	146	153	160	167	174	181	188	195	202	209	216	222	229	236	243	250	257	264	271	278	285	292	299	306	313	320	327	334	341	348	355	362	369	376																		
71	136	143	150	157	165	172	179	186	193	200	208	215	222	229	236	243	250	257	265	272	279	286	293	301	308	315	322	329	338	343	351	358	365	372	379	386																		
72	140	147	154	162	169	177	184	191	199	206	213	221	228	235	242	250	258	265	272	279	287	294	302	309	316	324	331	338	346	353	361	368	375	383	390	397																		
73	144	151	159	166	174	182	189	197	204	212	219	227	235	242	250	257	265	272	280	288	295	302	310	318	325	333	340	348	355	363	371	378	386	393	401	408																		
74	148	155	163	171	179	186	194	202	210	218	225	233	241	249	256	264	272	280	287	295	303	311	319	326	334	342	350	358	365	373	381	389	396	404	412	420																		
75	152	160	168	176	184	192	200	208	216	224	232	240	248	256	264	272	279	287	295	303	311	319	327	335	343	351	359	367	375	383	391	399	407	415	423	431																		
76	156	164	172	180	189	197	205	213	221	230	238	246	254	263	271	279	287	295	304	312	320	328	336	344	353	361	369	377	385	394	402	410	418	426	435	443																		

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**Appendix H****Strategies to Prevent Hypoglycemia and the Rule of 15 to Treat Hypoglycemia**

<b>Strategies to Prevent Hypoglycemia during Pregnancy with Preexisting Diabetes *(1, 2, 3, 4)</b>
❖ Check BG Frequently (at least 8-12 times per day)
❖ Divide 175 grams (or more) carbohydrates into 6 small meals 2 to 3 hours apart.
❖ Avoid more than 60 grams of carbohydrates in one meal (Insulin dose will be high and last longer)
❖ Always carry glucose meter, glucose tabs, and water
❖ Use insulin analogs such as glargine or detemir, as they are associated with less hypoglycemia
❖ Switch from MDI to CSII. Pump therapy is associated with lower rates of hypoglycemia
❖ Check blood glucose before exercise, Eat a 15 grams carbohydrate snack if BG is 100mg/dL or less before the workout. Check BG in midpoint and at the end of workout
❖ Check blood glucose before driving to ensure BG is within a normal range (>80mg/dL)
❖ Avoid delay of meals, snacks beyond 3-4 hours
❖ If blood glucose is less than 100 mg/dL one hour after the meal take another 15 grams carbohydrate.
❖ Eat breakfast within an hour after waking
❖ Avoid "stacking insulin, correcting high blood glucose without waiting 2 hours for insulin dose to work

\*1. Tkacs NC. Hypoglycemia unawareness. AJN. 2002;102(2):34-40.

\*2. Ringholm L Pedersen-Bjergaard U, Thorsteinsson B, et al. Hypoglycaemia during pregnancy in women with Type1 diabetes. Diabet Med.. 2012;29:558-566.

\*3. Boyle PJ, Zrebiec J. Management of diabetes related hypoglycemia. Southern Med J. 2007;100(2):183-194.

\*4. Cryer PE, Davis SN, Shamon H. Hypoglycemia in Diabetes. Technical Review. Diabetes Care, 2003;26(6):1902-1912.

**RULE OF 15 TO TREAT HYPOGLYCEMIA \*(4)**

Check blood glucose : if blood glucose < 70mg/dL apply the Rule of 15

The rule of 15 is:

- ❖ treat with 15 grams of carbohydrate,
- ❖ recheck blood glucose in 15 minutes, and
- ❖ expect to see a rise of blood glucose by 15 points minimum.

Instruct patient as follows:

Treat with 15 grams fast-acting carbohydrate:

- ❖ 4 glucose tabs with water or
- ❖ 8 ounces non-fat milk or
- ❖ 4 ounces juice

Check blood glucose in 15 minutes:

- ❖ blood glucose should increase at least 15 points
- ❖ If not 15 points higher or greater than 70, repeat treatment
- ❖ Once blood glucose is >70mg/dL, have a 15 gm snack with protein or a meal

\*4. Cryer PE, Davis SN, Shamon H. Hypoglycemia in Diabetes. Technical Review. Diabetes Care. 2003;1902-1912.

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**Appendix I**
**Insulin Adjustments During  
Betamethasone (BMZ) Use Algorithm**

Day One: BMZ 12 mg	Day Two: BMZ 12 mg	Days Three & Four:	Day Five:
Double all insulin doses (TDD) (Basal and bolus)	Continue with doubled doses and modify as needed for ( $\pm$ ) Target BG's	Decrease the previous day's increased doses by 50%. and add this to the original dose	Revert to pre betamethasone insulin doses
For <b>example</b> : If TDD insulin dose before Betamethasone = 50 units Day one = double TDD insulin dose = 100 units Day 2 = same as day 1 = 100 units Day 3 and 4 = half of insulin increase + TDD insulin dose = 25 + 50 = 75 units Day 5 = revert to TDD insulin dose = 50 units			
This algorithm must be individualized to patient response			

Mathiesen ER, Christensen ABL, Hellmuth E, et al. Insulin dose during glucocorticoid treatment for fetal lung maturation in diabetic pregnancy: test of analoritm. Acta Obstet Gynecol Scand. 2002;81:835-839.

Kitzmler JL, Jovanovic LB, Brown FM, et al. editors Managing preexisting diabetes mellitus and pregnancy: technical reviews and consensus recommendations for care. 2008. American Diabetes Association Alexandria, VA.

**Appendix J**

**CDAPP Sweet Success Guidelines for What Women with  
Preexisting Diabetes Can Expect During Labor, Delivery and  
Postpartum**

<b>Labor is Activity/Exercise</b>
<b>Healthy Coping</b>
Remember: Like exercise, labor lowers the body's need for insulin so your blood sugar (BS) is naturally lower. Pain and stress can increase the need for insulin and raise the BS level. Relaxation and pain medications can help control BS levels.
<b>Monitoring your BS</b>
During labor it is important to keep your BS level at 70–110 to prevent your baby from having hypoglycemia, low BS at birth. Your BS should be checked shortly after you arrive at the hospital. Your BS should then be checked every hour while you are in labor. (When on IV insulin your BS should be checked more frequently).
<b>Taking Medication</b>
If your delivery is being induced and you are still eating meals, take your rapid acting premeal insulin. If you are taking intermediate acting insulin (NPH) take this only as directed by your Sweet Success Team or your doctor. Usually AM NPH is not taken during the day of induction. Once labor starts or regular contractions occur, an IV insulin drip may be started to keep BG at 70-110mg/dL.
<b>Healthy Eating</b>
When labor begins you may be allowed to have only liquids. Stick to clear broth, diet Jell-O, diet popsicles, water and tea. These have no carbohydrates. There may come a point during your labor when you will not be allowed you to eat or drink anything. If your BS falls below 100 you may get an IV that contains sugar (called "D5").
<b>Reducing Risks To Your Baby After They Are Born</b>
The most common risk for your baby right after birth is hypoglycemia (BS level less than 45). You can help prevent the baby's low BS by keeping him/her warm and dry and by breastfeeding early and often. The best way to keep your baby warm and dry is by holding him/her skin to skin near your heart. A cold wet baby uses more BS and has a greater chance of hypoglycemia. It is important to breastfeed your baby within the first hour of life. Make sure you express some colostrum into the baby's mouth. Colostrum can help the sugar in the baby's liver to be released into the baby's blood stream. Breast feed at least every 2 hours to help keep the baby's BS within a normal range: (50 -120). The baby will have several BS checks during the first day of life depending on the hospital policy. If you have DM1 your blood sugar can drop significantly while breastfeeding so you should check your BG before and after feeding for the first few days. If your BG is <100mg/dL take a 15 gm carbohydrate snack without insulin.
<b>Problem Solving</b>
After the delivery of the placenta, you will need 0.3 to 0.5 of the last pregnancy dose of insulin. It is important for you to have your BS checked frequently: fasting, before and after meals, at bedtime and at 3 AM.
The first few weeks postpartum are a time of rapidly changing insulin needs. Frequent BG checks will help you to keep your BG in a healthy range: fasting/premeal <110 mg/dL and 1-2 hour postmeal <150-160 mg/dL. You should be seen by your provider within 2 weeks after delivery.

**Appendix K****Contraception Options for Women with Diabetes Mellitus**

<b>Method</b>	<b>Considerations for women with preexisting diabetes and gestational diabetes mellitus</b>
Barrier Methods - condoms, diaphragm, cervical cap	<ul style="list-style-type: none"> <li>❖ Higher failure rates.</li> <li>❖ Condoms provide protection against HIV and STD's. Failure rates improve with the addition of spermicides.</li> </ul>
Hormonal Methods - birth control pills, injections, patches, vaginal rings, and implants	<ul style="list-style-type: none"> <li>❖ Prevent ovulation, require monitoring of weight, blood pressure, pre and post glucose, fasting lipids, and vascular screen.</li> <li>❖ Not recommended for women who smoke or have micro and/or macrovascular complications.</li> <li>❖ Increase the incidence of depression.</li> <li>❖ May affect lipids by decreasing HDL and increasing LDL and cholesterol.</li> <li>❖ Combination pills not recommended until breastfeeding is well established at 6 weeks-3 months. Not shown to affect glucose intolerance.</li> <li>❖ Progestin only will increase glucose intolerance for preexisting DM and may require medication adjustment.</li> <li>❖ Progestin only for GDM will nearly triple the diabetes diagnosis above women using non-hormonal methods while breastfeeding. It is not recommended.</li> </ul>
Spermicides	<ul style="list-style-type: none"> <li>❖ High failure rates of 14-30% if used alone.</li> <li>❖ Due to high failure rate of this method, women should be offered on going preconception care.</li> </ul>
IUD	<ul style="list-style-type: none"> <li>❖ Up to 99% effective at preventing pregnancy.</li> <li>❖ Those that contain hormones do not have a systemic effect on blood glucose.</li> </ul>
Natural Family Planning - periodic abstinence, calendar method, ovulation method, symptothermal method, continuous breastfeeding, and withdrawal.	<ul style="list-style-type: none"> <li>❖ Significant failure rates of 0.2-27%</li> <li>❖ Due to high failure rate of this method, women should be offered on going preconception care.</li> </ul>
Sterilization	<ul style="list-style-type: none"> <li>❖ Surgical procedure, usually not reversible.</li> </ul>
Emergency Contraception	<ul style="list-style-type: none"> <li>❖ 1-2% failure rate and is only method post sexual activity.</li> <li>❖ Progestin in these products may temporarily disrupt glucose control.</li> </ul>

---

**Appendix L**

# Nutrition Tips

## For Women who Breastfeed and Take Insulin

“I have diabetes. I take insulin to control my blood sugar. When I was pregnant I decided I was going to breastfeed my baby. Breastfeeding is the best thing for both of us.”



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Breastfeeding is good for you and your baby. Your breastmilk is the best food for your baby. Your baby will not get diabetes from your breastmilk. Breastmilk helps prevent your baby from having diabetes later in life.

**The longer you breastfeed, the better it is for you and your baby. Breastfeed for at least one year.**

Right after your baby is born, **your insulin needs are lower**. Breastfeeding also lowers your insulin needs. You may need to use less insulin and change your meal plan to stay in good blood sugar control. Keep in touch with your health care team to learn your blood sugar goals for breastfeeding.



Here are some tips to help you breastfeed:

- 1 Breastfeed your baby often (eight to twelve times each day). This will help you **make more milk**.
- 2 Sip on a beverage each time you breastfeed.
- 3 Your blood sugar levels may drop quickly during or after breastfeeding. To keep your blood sugar from getting too low you should:
  - ❖ Nap **after** meals or snacks, **not** before.
  - ❖ Have a snack just before or while you breastfeed your baby. This may help prevent you from having low blood sugar. Your snack should include 1 serving from the starch, fruit or milk group. You could have:
    - 1 slice of toast or 6 crackers, or
    - 1 small apple or 1 cup of melon, or
    - 1 cup of yogurt or 1 cup of low fat milk
  - ❖ Learn how your blood sugar responds to breastfeeding. Test your blood sugar before and after you breastfeed at least once so you can see the effect on your blood sugar.
  - ❖ With the help of your health care team, adjust your meal plan and insulin so that your blood sugar is a little higher than when you were pregnant. Aim for blood sugar levels of less than 155 - 160 mg/dl at one hour after meals.

- 4 Continue to eat healthy foods. Follow the meal plan you were given when you were pregnant until you can meet with your dietitian.
- 5 Limit the amount of fats you eat each day. Some examples of fats are:
  - ❖ butter
  - ❖ oil
  - ❖ salad dressing
  - ❖ bacon
  - ❖ sour cream
  - ❖ mayonnaise
- 6 Eat high fiber foods. Some examples of high fiber foods are:
  - ❖ beans
  - ❖ whole grains
  - ❖ vegetables
- 7 Be aware of your baby's growth spurts. Your meal plan and insulin needs may change during these times.
- 8 If you have type 2 diabetes, stay on insulin while you breastfeed. **If you are not able to stay on insulin, talk to your health care team about other medicine choices.**
- 9 Get to a weight that is best for your height. Lose weight slowly. Try to lose between 1 and 4 1/2 pounds a month. Talk to your health care team about healthy ways to lose weight. Try the following:
  - ❖ Set a weight goal. Break your main goal into smaller "mini" goals. For example, you may want to lose a total of 30 pounds. Your first "mini" goals might be to lose 3 pounds this month.
  - ❖ Do not use diet pills!
  - ❖ Talk with a dietitian to help you plan a healthy diet.
- 10 Ask your health care team if you need to take any vitamin or mineral pills.
- 11 Plan an exercise routine. Walking is a good choice.



# Sample Menu

Time	Meal Plan	Menu Ideas
Breakfast 7:00am	Milk 0 Starch 1 Fruit 0 Vegetable 1 Protein 2 Fat/Oil 1	1/2 cup <b>non-instant</b> oatmeal  1 cup chopped onion, tomato, bell pepper mixed in eggs 2 eggs 1 tsp canola oil (to fry eggs and vegetables)
Snack 9:30am	Milk 1 Starch 1	1 container no sugar added, low fat yogurt 3 cups plain popped corn
Lunch 12:00pm	Milk 0 Starch 1 Fruit 0 Vegetable 1 Protein 2 Fat/Oil 1	2 slices whole wheat bread  lettuce, tomato, sprouts (on sandwich) 2 oz sliced turkey 2 tsp mayonnaise
Snack 3:00pm	Protein 1 Starch 1 Fruit 1	1 oz low fat cheese 1 tortilla (6 inches) 17 small grapes
Dinner 6:00pm	Milk 0 Starch 1 Fruit 0 Vegetable 1 Protein 2 Fat/Oil 1	1 cup 1% milk 1/3 cup cooked brown rice 1 small apple 1 cup broccoli 2 oz lean beef 1 tsp margarine
Snack 9:00pm	Protein 1 Starch 1 Fruit 1	1 cup 1% milk 1 tbsp natural peanut butter 1 slice whole wheat bread

## If you need help call:

Your health care provider or clinic: \_\_\_\_\_

Breastfeeding Resource Listing: 1 800 835-5968

Lactation Program: \_\_\_\_\_

La Leche League International: 1 800 525 -3243

Wellstart International: 1 619 295 -5193

WIC: \_\_\_\_\_

For diabetes and pregnancy information go to:

[www.CDAPPSweetSuccess.org](http://www.CDAPPSweetSuccess.org)



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***For more information:***

California Department of Public Health, Center for Family Health  
Maternal Child and Adolescent Health Division  
California Diabetes and Pregnancy Program (CDAPP) Sweet Success  
Guey-Shiang Tsay, RN, MSN  
(916) 650-0300

<http://www.cdph.ca.gov/programs/CDAPP>

or

California Diabetes and Pregnancy Program (CDAPP) Sweet Success  
Resource and Training Center  
Cynthia Peña, MPH, MSW  
(858) 536-5090

<http://www.CDAPPSweetSuccess.org>



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# ▶ *CDAPP Sweet Success* *Guidelines* *for Care*

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## Chapter 4

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### Medical Management and Education for Gestational Diabetes Mellitus



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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

Carbohydrate 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 has developed the algorithm “Guidelines for Diagnosis of Hyperglycemia in Pregnancy-2011” which includes early detection of GDM (Appendix A).

GDM accounts for approximately 90% of all diabetic pregnancies. From 1997 to 2005, the incidence of GDM has doubled in California to 7.6% (3). The trend toward increased GDM is attributed to unhealthy diet, obesity, sedentary lifestyle, improved screening, maternal exposure to high blood glucose levels in-utero, and new diagnostic guidelines (2, 4, 5, 6).

### RISK ASSESSMENT AND EARLY SCREENING

Table 1 lists high risk indicators for an early GDM screen.

<b>Table 1. HIGH RISK INDICATORS FOR EARLY SCREEN FOR GDM (First Prenatal visit) (2, 7, 8)</b>
❖ 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 (i.e. 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)

Table 2 lists diagnostic criteria for GDM.

<b>Table 2. DIAGNOSING GDM BASED ON 75 GRAM, 2-HR ORAL GLUCOSE TOLERANCE TEST (2, 8)</b>
Diagnostic blood glucose values: Fasting: $\geq 92$ mg/dL One hour: $\geq 180$ mg/dL Two hour: $\geq 153$ mg/dL
One abnormal value is diagnostic of GDM.

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 nearly a three-fold increase of macrosomia and nearly a four-fold increase in newborn hypoglycemia (9).

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

<b>Table 3. FETAL COMPLICATIONS DUE TO POORLY CONTROLLED MATERNAL BLOOD GLUCOSE (4, 5, 6, 10)</b>	
<ul style="list-style-type: none"> <li>• Shoulder dystocia</li> <li>• Other birth injuries</li> <li>• Hypoglycemia</li> <li>• Poor feeding</li> <li>• Hyperbilirubinemia</li> </ul>	<ul style="list-style-type: none"> <li>• Jaundice</li> <li>• Respiratory distress</li> <li>• Polycythemia</li> <li>• Hypocalcemia</li> <li>• Stillbirth</li> </ul>

Long- term risks to offspring from poor maternal glycaemic control include (11, 12, 13):

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



Table 4 lists criteria for diagnosing overt diabetes during pregnancy.

<b>Table 4. CRITERIA FOR THE DIAGNOSIS OF OVERT DIABETES DURING PREGNANCY (2)</b>
❖ A1c $\geq$ 6.5% at 13 weeks or more gestation. The test should be performed in a laboratory using a method that is National Glycohemoglobin Standardization Program (NGSP) certified and standardized to the Diabetes Control and Complications Trial (DCCT) assay.
<b>OR</b>
❖ FPG $\geq$ 126 mg/dl. Fasting is defined as no caloric intake for at least 8 hours.
<b>OR</b>
❖ Two-hour plasma glucose $\geq$ 200 mg/dL during an OGTT. The test should be performed as described by the World Health Organization, using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water.
<b>OR</b>
❖ In a patient with classic symptoms of hyperglycemia or hyperglycemic crisis, a random plasma glucose $\geq$ 200 mg/dl.

Table 5 addresses 3rd trimester GDM screening methods for women who have experienced hyperemesis or who have undergone gastric bypass surgery. Abnormal results from any of these methods should receive a diagnosis of GDM and be treated.

<b>Table 5. GDM SCREENING FOR WOMEN WHO HAVE HYPEREMESIS OR HAVE UNDERGONE GASTRIC BYPASS (2, 14, 15, 16)</b>
❖ Check FPG and plasma glucose 1 hour after a meal at gestational weeks of 22-24, 28-32, and 34, while she continues her usual diet.
<b>OR</b>
❖ Obtain fasting and 1 hour post-meal blood glucose for 1 week with a blood glucose meter while she continues her usual diet.
<b>OR</b>
❖ A1c $\geq$ 6.5%, $\geq$ 13 weeks gestation. The test should be performed in a laboratory using a method that is NGSP certified and standardized to the DCCT assay.

### Initial Prenatal Visit

The initial visit for diabetes care while pregnant including (17, 18, 19, 20):

- ❖ a thorough review of the medical and obstetric history, current condition(s), and medications taken by the pregnant woman
- ❖ physical Assessment including:
  - ◆ Height
  - ◆ Weight
  - ◆ Blood pressure during the initial visit and on subsequent visits. Women with GDM are at high risk for hypertensive disorders during pregnancy
  - ◆ Test urine protein during the initial visit and as indicated, especially if the woman has signs and symptoms of preeclampsia

### 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 (21, 22). Glycemia subsides and insulin and glucose levels return to premeal levels within two hours (23). 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 (24).

The blood glucose targets we aim for are included in Table 6.

<b>Table 6. BLOOD GLUCOSE TARGETS DURING PREGNANCY (9, 25, 26, 27)</b>	
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. Medication is initiated 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 (28).

While insulin has long been the treatment of choice, new evidence supports the use of OHAs in the management of GDM (29, 30). Women utilizing OHA should continue diet, exercise, blood glucose testing and receive fetal surveillance as with insulin management.

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 (31).
- ❖ Hypoglycemia is common with glyburide use.
- ❖ Maximum drug peak in pregnancy occurs 2-4 hours after intake with a prolonged ‘second stage’ response (32).
- ❖ The glucose peak after a carbohydrate load is 90 minutes (22).
- ❖ Generally, the medication is taken twice daily, 1 hour before meals.
- ❖ Glyburide failure occurs in approximately 20% of patients (33, 34).

Table 7 describes the Glyburide Protocol.

<b>Table 7. GLYBURIDE PROTOCOL (29)</b>
❖ Begin with 1.25 mg/day (maternal body weight < 200 lb) or 2.5 mg (maternal body weight >= 200 lb) either in the AM or PM depending on individual needs.
❖ 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 and is not present in appreciable concentrations in breast milk.

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 values (35)

#### Metformin

Metformin, another OHA is a biguanide or an insulin sensitizer. Metformin, with its smaller molecular weight, crosses the placental barrier (36, 37, 38). 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 during the first 18 months of life (39).

#### Metformin Facts:

- ❖ Does not cause hypoglycemia
- ❖ If women are taking metformin prior to pregnancy or at the first prenatal visit, it is recommended they continue to take metformin (40, 41)
- ❖ Crosses the placenta and crosses into breast milk (36, 38, 42)
- ❖ Breastfeeding with metformin appears to be safe with no difference between infants breastfed by women not taking metformin (36, 43, 44)
- ❖ Metformin utilization is associated with improved lactogenesis in women with Polycystic Ovary Syndrome (PCOS) (36, 43, 44)

Table 8 describes the protocol for the use of Metformin.

<b>Table 8. METFORMIN PROTOCOL (36, 45, 46)</b>
❖ 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.

Tables 9 & 10 list two recommended Insulin Protocols for GDM.

<b>Glucose Value</b>	<b>Insulin Dose</b>
AM Fasting (FPG) >90 mg/dl, <120 mg/dl	<b>8 - 20 units basal or long acting (NPH) @ bedtime</b> (0.165 to 0.2 units/kg actual body weight).
1-hour post breakfast >130 mg/dl, <180 mg/dl	<b>2 - 4 units of rapid acting analog bolus</b> pre-breakfast.
1-hour post lunch >130 mg/dl, <180 mg/dl	<b>2 - 4 units rapid acting analog</b> pre-lunch <b>OR</b> Add <b>4 - 6 units NPH</b> to pre-breakfast injection (and eat lunch 4 - 5 hrs after breakfast).
1-hour post dinner >130 mg/dl, <180 mg/dl	<b>2 - 4 units rapid acting analog</b> pre-dinner.

A second option for insulin calculation is in the following table which is modified from work by Hone and Jovanovic, 2010 (48). This is recommended in women presenting with blood glucose values higher than or equal to 120 mg/dL fasting and 180 mg/dL post meal.

<b>Table 10. INSULIN CALCULATION BY GESTATIONAL AGE AND BODY WEIGHT FOR GDM - Option 2 (48, 49)</b>	
<b>Gestational Age</b>	<b>Insulin Dose</b>
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
36-40 weeks	0.9-1 units per kg actual body weight
<p>After calculating the total daily dose (TDD) of insulin for 24 hours, based on gestational age and body weight, divide it into 50% mealtime rapid acting insulin analog (<b>bolus</b>) and 50% NPH insulin (<b>basal</b>).</p> <ul style="list-style-type: none"> <li>• <b>Bolus:</b> Divide so that 1/6 of TDD is rapid-acting insulin given before each meal, (breakfast, lunch and dinner). The rapid-acting insulin is then titrated based on the blood glucose and carbohydrate distribution.</li> <li>• <b>Basal:</b> Divide so that 1/6 of TDD is NPH given before breakfast, 1/6 of TDD is NPH given before dinner, and 1/6 of TDD is NPH given before bedtime.</li> <li>• <b>Insulin is frequently adjusted based on blood glucose patterns, meal plan adjustments and activity.</b> <ul style="list-style-type: none"> <li>o If today's blood glucose (BG) 1 hour after a meal is &lt; 110, then decrease tomorrow's pre-meal (for that meal) rapid insulin by 2 units.</li> <li>o If today's 1 hour BG after a meal is 111-120, no change in tomorrow's pre-meal rapid insulin.</li> <li>o If today's BG 1 hour after a meal is &gt; 121, then increase tomorrow's pre-meal (for that meal) rapid insulin by 2 units.</li> </ul> </li> </ul>	

### Key Points for Initiating Insulin Therapy

Self-monitoring 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 (10). 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 with betamethasone can be found in the chapter on [Medical Management and Education for Preexisting Diabetes During Pregnancy \(Ch 3\)](#) in the section that addresses antepartum hospitalization for women with preexisting diabetes.

**HELPING WOMEN  
PREPARE FOR LABOR  
AND DELIVERY**

Table 11 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.

<b>Table 11. LABOR, DELIVERY, &amp; POSTPARTUM EDUCATION FOR GDM (28, 49)</b>
❖ 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 Congress 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 (50). Delivery prior to 38 weeks gestation may still be indicated, and the woman should undergo amniocentesis to document fetal pulmonary maturity when feasible (49, 50).

### 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 (50). The literature clearly shows that elevated maternal blood glucose levels in the last 18 hours before delivery are more strongly correlated with neonatal hypoglycemia than in the entire pregnancy up to that point (51). Control of maternal blood glucose levels during labor can reduce the incidence of neonatal hypoglycemia, even among women with poor antepartum glycemic control (52). Maternal blood glucose concentrations greater than 115 mg/dL – 117 mg/dL increase the incidence of neonatal hypoglycemia (53, 54).

Glucose utilization is increased during the active phase of labor, but tapers as soon as the second stage is reached. Labor requires very little additional exogenous insulin and appears to mimic the serum insulin concentrations of a trained runner during a marathon (55).

Table 12 describes the guidelines for intrapartum IV insulin use.

Blood Glucose (mg/dL) Check BG hourly	IV solution and rate	250 units regular Insulin/250mL Normal Saline
< 70 mg/dL	See managing hypo- glycemia in <a href="#">Table 14</a>	OFF
71 - 90 mg/dL	<b>May use D5LR or ½ NS @ 100mL/hr when BG is less than 100mg/dL</b>	
91 - 100 mg/dL		
101 - 130 mg/dL	<b>LR or NS @100mL/hr while BG is more than 100 mg/dL</b>	1 unit insulin/hr
131 - 150 mg/dL		2 units insulin/hr
151 - 170 mg/dL		3 units insulin/hr
171 - 190 mg/dL		4 units insulin/hr
> 190 mg/dL	check ketones, notify MD and receive new orders to modify insulin	



Table 13 discusses the Management of GDM during labor and delivery.

<b>Table 13. MANAGEMENT OF GDM DURING LABOR AND DELIVERY (53, 54, 55, 56)</b>		
<b>CRITICAL POINTS</b>	<b>GDM A1 (diet and exercise controlled)</b>	<b>GDM A2 (requires addition of oral agents and/or insulin for control)</b>
<b>Diet</b>		
<p>Assess all women admitted to the labor and delivery unit for the content and time of the last meal eaten.</p> <p>Careful attention should be directed towards carbohydrate (CHO) intake whether oral or intravenous.</p> <p>Rapid infusion of glucose should be avoided as this will cause fetal hyperinsulinemia.</p>	<p><b>Early labor:</b> CHO controlled diet as per pregnancy</p> <p><b>Active labor:</b> If clear liquids: Use <u>CHO controlled</u> liquids If BG is &lt;100mg/dL use 30 gms CHO every 2-3 hours If BG &gt;100mg/dL use non-caloric clear liquids</p> <p>If NPO: Have LR as main line with D5 IVPB connected close to insertion site of LR If BG &lt;100 mg/dL use IV D5 @ 100 mL per hour If BG is &gt;100 mg/dL use LR @ 100 ml per hour</p>	<p><b>Early labor:</b> CHO controlled diet as per pregnancy</p> <p><b>Active labor:</b> If clear liquids: Use <u>non caloric</u> clear liquids</p> <p>If NPO: Have LR as main line with D5 IVPB connected close to insertion site of LR If BG &lt;100 mg/dL use IV D5 @ 100 ml per hour If BG is &gt;100 mg/dL use LR @ 100 ml per hour</p>
<b>Blood Glucose (BG) Monitoring</b>		
<p>Obtain BG on admission</p> <p>Frequent monitoring of BG is the key to maintaining normoglycemia during labor.</p>	<p><b>Early labor:</b> While eating: Check FBG and 1 hour after start of meals</p> <p><b>Active labor:</b> Check BG every 2 hours and just before delivery</p>	<p><b>Early labor:</b> While eating: Check FBG and 1 hour after start of meals.</p> <p><b>Active labor:</b> Check BG every 1-2 hours. When on IV insulin, check every 1 hour or more. Check just before delivery.</p>
<b>Medication</b>		
<p>Assess all women admitted to the labor and delivery unit requiring insulin or oral agents for the time, type and dose of oral <b>medication or insulin</b> taken.</p> <p>If insulin is required the most effective way to achieve glycemic control is to use insulin by intravenous route.</p>	<p>Because of increased glucose utilization during labor, it is rare for women with GDM A1 to require insulin as long as BG remains less than 110 mg/dL.</p>	<p>Discontinue oral agents for glucose control on day of induction or with onset of labor.</p> <p>Women with GDM A2 may or may not require insulin in labor</p> <p>If BG &gt;110mg/dL, remove glucose source. Repeat BG in 30 minutes</p> <p><b>If BG remains &gt;110 mg/dL, then IV insulin should be initiated (See Table 12)</b></p>

Table 14 addresses risk reduction and problem solving during labor and delivery.

<b>Table 14. RISK REDUCTION AND PROBLEM SOLVING DURING LABOR AND DELIVERY (53, 54, 55, 56)</b>	
<b>Managing Hypoglycemia</b>	
<b>Have D50 IV solution and glucagon readily available although it is extremely rare that either of these will be needed.</b>	
<p>Recognize symptoms of hypoglycemia. <b>If any are present, check BG:</b></p> <ul style="list-style-type: none"> <li>❖ hunger</li> <li>❖ nervousness and shakiness</li> <li>❖ perspiration</li> <li>❖ dizziness or light-headedness</li> <li>❖ sleepiness</li> <li>❖ confusion, irritability</li> <li>❖ difficulty speaking</li> <li>❖ feeling anxious or weak</li> </ul>	<p><b>For BG less than 70mg/dL greater than 50mg/dL:</b></p> <p>While taking food or fluids on IV insulin:</p> <ol style="list-style-type: none"> <li>1. Stop IV insulin infusion and notify MD</li> <li>2. Use 8 oz non fat milk or 15 gm CHO</li> <li>3. Check BG in 15 minutes</li> <li>4. BG should rise at least 15 points</li> <li>5. If BG remains less than 70 mg/dL repeat intervention #2 and #3.</li> <li>6. Notify MD</li> </ol> <p>When NPO on IV insulin:</p> <ol style="list-style-type: none"> <li>1. Stop IV insulin infusion and notify MD</li> <li>2. Infuse D5 solution at 200 mL/hour X 15 min</li> <li>3. Recheck BG</li> <li>4. If &lt; 70 repeat #2 &amp; #3</li> <li>5. If &gt; 70 return IV D5 to 100 mL/hr</li> <li>6. Notify MD.</li> <li>7. Per MD order, restart insulin infusion per modified algorithm</li> </ol> <p><b>For BG less than 50 mg/dL when patient is conscious:</b></p> <ol style="list-style-type: none"> <li>1. Stop IV insulin infusion and notify MD</li> <li>2. Change infusion to D10 @ 200 ml/hr</li> <li>3. Check BG in 15 minutes.</li> <li>4. Continue D10 until BG is &gt; 70 mg/dL</li> <li>5. When BG is &gt; 70mg/dL resume D5 at 100mL/hr and resume insulin per MD order</li> </ol>
<b>Other Complications</b>	
<p>Be alert to high risk for following complications</p> <ul style="list-style-type: none"> <li>❖ <b>Preeclampsia:</b> Observe for signs and symptoms: monitor BP, urine output and proteinuria</li> <li>❖ <b>Labor abnormalities:</b> Monitor labor progress and intervene early for abnormalities such as slow or no progress</li> <li>❖ <b>Chorioamnionitis:</b> Watch for early signs of infection</li> <li>❖ <b>Shoulder dystocia:</b> Prepare patient for McRobert's maneuver</li> <li>❖ <b>Cesarean delivery:</b> Secure availability of Obstetrician, Anesthesiologist, &amp; Pediatrician</li> </ul>	
<b>Pain Management</b>	
<p>In addition to above parameters for BG checks during labor, check BG in relationship to pain, stress and medications</p>	<p>Keep in mind:</p> <ul style="list-style-type: none"> <li>❖ Pain can increase BG by releasing catecholamines</li> <li>❖ Stress can increase BG by releasing the stress hormone cortisol</li> <li>❖ Ephedrine, often used to raise BP with epidural associated hypotension, can raise BG for up to 4 hours.</li> <li>❖ Narcotics can lower BG levels by reducing the stress hormone cortisol</li> </ul>

**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 15.

<b>Table 15. GDM PROTOCOL FOR DAYS 1 - 3 POSTPARTUM (56, 57, 58, 59, 60)</b>	
<b>GDM A1 (diet and exercise controlled)</b>	<b>GDM A2 (requires addition of oral agents and/or insulin for control)</b>
<b>Diet</b>	
<p><b>When eating:</b>                      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.</p> <p><b>If NPO:</b>                      If BG &lt;130 mg/dL <b>may use</b> IV D5 @ 100 ml per hour                      If BG is &gt;130 mg/dL use LR @ 100 ml per hour</p>	
<b>Medication</b>	
Glucose lowering medications not needed	See Insulin Management section above for postpartum use of IV insulin. <ul style="list-style-type: none"> <li>• There is rarely a need for subcutaneous insulin postpartum.</li> <li>• May consider use of Metformin if medication is needed to bring BG into normal range. Metformin use in breastfeeding was found to be efficacious.</li> </ul>
<b>Blood Glucose Monitoring</b>	
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.
<b>Breastfeeding to Reduce Risk of Type 2 Diabetes</b>	
Breastfeeding has been shown to reduce the risk of type 2 diabetes in the mother and baby (58, 59). <ol style="list-style-type: none"> <li>1. Early (preferably in the first half hour of life) and often (10 -12 times per 24 hours)                             <ol style="list-style-type: none"> <li>a. breastfeeding can reduce the risk of hypoglycemia for the newborn.</li> </ol> </li> <li>2. Women who undergo cesarean birth should not be an exception.</li> <li>3. Provide care (physical assessment and glucose monitoring) needed by couplet without separating them.</li> <li>4. 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.</li> </ol> <p>(Impact of Maternal Diabetes on Fetal Development &amp; Neonatal Care Needs Chapter (Ch 5))</p>	
<b>Follow up</b>	
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 (22, 61, 62). In a study of women 6 weeks to 28 years postpartum by Kim it was determined that the cumulative incidence of diabetes ranged from 2.6% to over 70%. This incidence increased markedly in the first 5 years after delivery, and appeared to plateau after 10 years (63). 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 (60).

Table 16 summarizes the risk factors for a recurring GDM pregnancy.

<b>Table 16. RISK FACTORS FOR RECURRING GDM (1, 61, 64, 65)</b>
❖ 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
❖ Deliver 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 (66, 67). The offspring of women with GDM, who were large or small for gestational age, are at future risk for cardiovascular disease, obesity and diabetes (11, 59). Well in advance of delivery education concerning long term risk reduction should be incorporated during all CDAPP 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. Annually, approximately 8% to 12% of women who had GDM will convert to diabetes (63, 68). Lifestyle changes can reduce the rate of conversion to diabetes by up to 58% (61, 69). 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 (61, 70, 71, 72, 73).

One third of the women with a history of GDM will have abnormal lipid profiles and metabolic syndrome (60, 74).

Table 17 summarizes the postpartum recommendations for women with GDM.

<b>Table 17. POSTPARTUM RECOMMENDATIONS FOR WOMEN WITH GDM (7, 8, 60, 75, 76)</b>	
Periodically Evaluate Glucose Tolerance	<ul style="list-style-type: none"> <li>❖ 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.</li> <li>❖ If the screen is normal, repeat at 1 year after delivery and every three years thereafter as long as values remain within normal limits.</li> <li>❖ Encourage women to obtain a glucose screen before conceiving again.</li> <li>❖ Subsequent pregnancy should include early prenatal care, risk assessment, and testing for GDM or diabetes with a 2 hr-75 gm OGTT.</li> <li>❖ 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.</li> <li>❖ If diabetes is diagnosed postpartum, refer the woman to a diabetic health care provider for follow up and ongoing care.</li> </ul>
Evaluate for Metabolic Risk Factors	<ul style="list-style-type: none"> <li>❖ 1 year after delivery and yearly thereafter.</li> <li>❖ 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.</li> </ul>
Coordination of Care	<ul style="list-style-type: none"> <li>❖ Coordinate care with the primary care provider or obstetrician and the baby's pediatrician.</li> <li>❖ Notify them of the woman's gestational diabetes and need for continued follow-up.</li> <li>❖ Refer to a provider familiar with diabetes care who will be vigilant concerning interconception and preconception health concerns for women with previous GDM.</li> </ul>

### **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. For more information, refer to the [Nutrition Chapter \(Ch 7\)](#).

The chapter on [Breastfeeding \(Ch 8\)](#) provides more details on the unique benefits of breastfeeding for women with diabetes and their offspring.

### **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, and depressive symptoms, and increased risk of developing Type 2 diabetes ([70](#), [77](#), [78](#), [79](#), [80](#), [81](#)). Refer to the [Exercise \(Ch 6\)](#) chapter 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 ([79](#)). 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 ([61](#), [82](#), [83](#), [84](#), [85](#)). Refer to the [Preconception and Interconception Care for Preexisting Diabetes Chapter \(Ch 2\)](#) for a review of birth control 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 varied for different racial groups (61, 63).

Even women with mild gestational diabetes are at increased risk of developing cardiovascular disease (68). Regular physical check-up 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, which increases the incidence of type 2 diabetes, even in the absence of any other risk factors (81, 86). 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 (86, 87). In addition, assess for sleep deprivation which can increase depression and result in unhealthy coping. Refer to the **Behavioral and Psychosocial Components of Care (Ch 9)** chapter for additional information.

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## Guidelines for Diagnosis of Hyperglycemia in Pregnancy – 2011

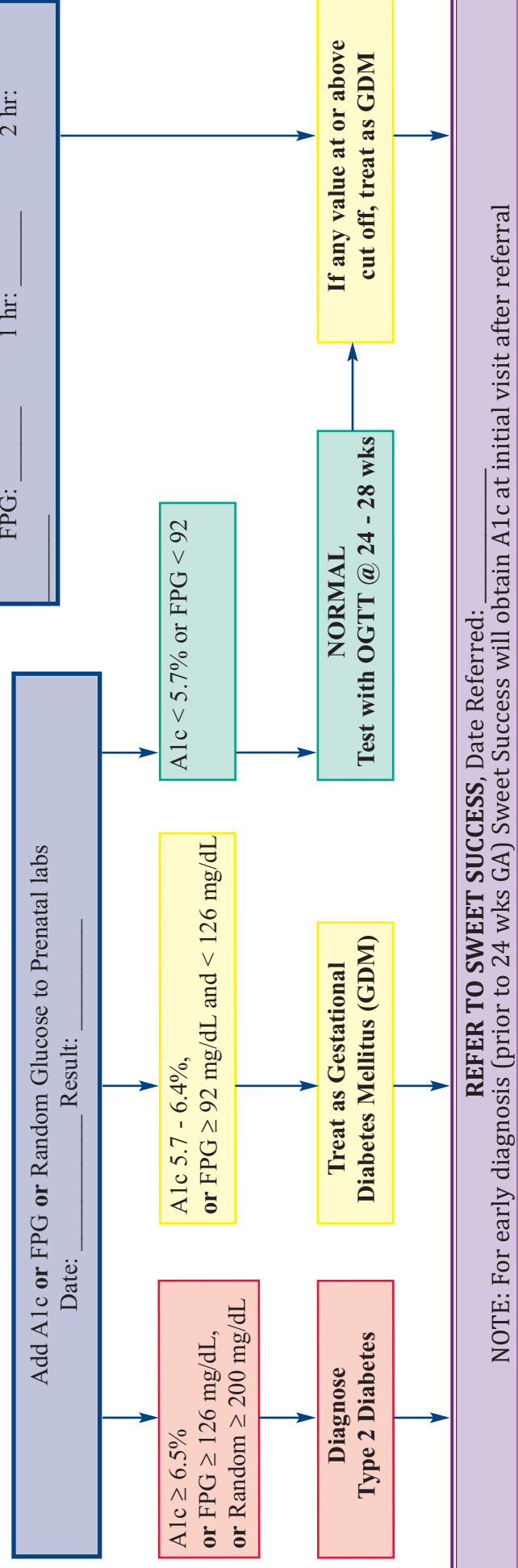
### First Prenatal Visit (< 13 wks)\*

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  $\geq 25$  (at risk BMI may be lower in some ethnic groups<sup>1</sup>)
- 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<sup>1</sup> 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

\* 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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# ▶ *CDAPP Sweet Success* *Guidelines* *for Care*

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## Chapter 5

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### Impact of Maternal Diabetes on Fetal Development and Neonatal Care



*Sweet  
Success*

California Diabetes and Pregnancy Program

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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 hyperglycemia has as much as 7.9% higher risk of having congenital malformations than infants born to mothers without diabetes (1, 2, 43). 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 (A1c) and spontaneous abortion or major malformations of fetus/infants that progressed beyond the first trimester. Table 1 lists some of the results of that study and includes the number of women who experiences spontaneous abortions and the number of infants with major malformations (3).

Hemoglobin A1c (%)	Spontaneous Abortions (number of women affected)	Major Malformations for pregnancies beyond the first trimester (number of fetus/infants affected)
≤ 9.3	14	3
9.4 to 11.0	7	4
11.1 to 12.7	15	2
>12.8	16	11

\* based on 303 insulin requiring diabetic women

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 (4, 5, 6). Comorbidities associated with obesity during childhood and adulthood include an increased incidence of metabolic

syndrome, hypertension, lipid abnormalities (7), renal disease (8), risk of type 2 diabetes (9), and psychomotor, memory and learning deficits (10, 11, 12).

The fetus of a woman with 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 1 and type 2 diabetes, these conditions contribute to a high perinatal mortality due to hyperglycemia-induced teratogenicity. Preconception care with strict glycemic control significantly reduces hyperglycemia-related mortality and morbidity (13, 14). As shown in Table 2, maternal hyperglycemia is associated with an abnormal intrauterine environment. By the eighth week of gestation, diabetic embryopathy (birth defects and spontaneous abortions) may occur (14). Subsequently, diabetic fetopathy (macrosomia and fetal hyperinsulinemia) occurs during the second and third trimesters (14).

<b>Table 2: PERINATAL MORTALITY AND NEONATAL MORBIDITY IN INFANTS OF DIABETIC MOTHERS</b> (3, 13, 15, 16, 17, 18, 19, 20, 21, 22)	
<b>Complications</b>	<b>Reported rates (%)</b>
Perinatal mortality*	0.6 - 4.8
Cesarean delivery*	32 - 45
Premature deliveries <37 weeks gestation <34 weeks gestation	24 - 33 14 - 16
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** Hypocalcemia Polycythemia Hyperbilirubinemia	5 - 25 4 5 - 33 11 - 29
Cardiomyopathy Symptomatic Asymptomatic	2 - 10 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 (3, 18, 23, 24, 25). A program of preconception care, strict glycemic control prior to conception and during pregnancy, and the use of antepartum fetal surveillance in women with type 1 or type 2 diabetes may reduce the rate of congenital malformations (2, 16).

However, hyperglycemia alone does not offer a complete explanation for the teratogenic process. More recent findings indicate multifactorial etiology including myoinositol effects, arachidonic acid deficiency, hyperglycemia altering gene cell signaling, hyperketonemia, and excess of free oxygen radicals (14, 26).

### 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) (27). Macrosomic neonates display significantly more hyperinsulinemia than appropriate for gestational age (AGA) infants (28).

### 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 (29). 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 (30). Increased growth velocity in the third trimester has been identified in the large for gestational age (LGA) infant of a diabetic mother. This increased circumferential growth is observed by 32 weeks' gestation in LGA fetuses (1.36 cm/week) compared to AGA fetuses (0.9 cm/week) (29).

When blood glucose control is extremely tight with an average blood glucose of <67 mg/dl, fetal growth will slow but then the infant is at risk of becoming small for gestational age (SGA) (31, 32).

### **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 lambs (33). Hypoxemia stimulates erythropoietin synthesis resulting in polycythemia (34, 35). Polycythemia is associated with an increased rate of neonatal jaundice.
- ❖ Chronic fetal hyperinsulinemia and hyperglycemia result in glycogen loading and stiffening of the intraventricular septum, resulting in fetal cardiomyopathy (36).

Fetal hypoxemia may contribute to the 20% to 30% rate of stillbirth seen in poorly controlled diabetic pregnancies (17).

### **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. It is two to three times more common in diabetic than nondiabetic pregnancies (37, 38).

Macrosomia is caused by excessive nutrient supply, which causes increased fetal growth, particularly of insulin-sensitive tissues (liver, muscle, cardiac muscle, and subcutaneous fat) (36). Excessive growth is associated with poor maternal glucose control, especially during the third trimester (39, 40) and can be minimized by optimal maternal glycemic control (40).

Macrosomia is associated with an increased risk of (7, 41, 42):

- ❖ Cesarean delivery
- ❖ Newborn hyperglycemia
- ❖ Hypoglycemia in an otherwise healthy newborn
- ❖ 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 a woman with diabetes at a rate two to four times higher than in the general population (18). 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. The systems most commonly affected in the infant of a diabetic mother are cardiovascular, central nervous and neural tube, skeletal, gastrointestinal and genitourinary. Early identification through maternal serum alpha-fetoprotein, ultrasound examination, and careful physical examination of the fetus and neonate is indicated to ensure appropriate preparation and referral for delivery and/or subspecialty intervention (14, 26).

#### 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 (43). Congenital malformations account for approximately 50% of the perinatal deaths in newborns born to women with type 1 diabetes (36). 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 (43). Table 3 summarizes congenital anomalies associated with infants of diabetic mothers.

#### Type 2 Diabetes

Birth defects due to hyperglycemia are also seen in the infants of women with type 2 diabetes (13). Since birth defects are associated with obesity, women with type 2 diabetes who are also obese may have an increased risk above that based on just hyperglycemia. Obese women (BMI > 30) were more likely than average-weight women to have an infant with spina bifida (unadjusted odds ratio [OR] 3.5), omphalocele (OR 3.3), heart defects (OR 2.0), and multiple anomalies (OR 2.0) (44, 45).

<b>Table 3: CONGENITAL ANOMALIES ASSOCIATED WITH INFANTS OF DIABETIC MOTHERS (14, 26)</b>	
<b>Systems</b>	<b>Anomalies</b>
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 (19, 46).

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

- ❖ Premature labor occurred in 31% of 181 pregnancies among women with type 1 diabetes compared to 20% in a control population (46).
- ❖ A similar preterm delivery rate of 31% was noted in a study of women with type 2 diabetes (13).
- ❖ One study showed that a third of 110 diabetic pregnancies delivered prematurely because of preeclampsia (16).

### 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 162 diabetic women, 27% of fetuses had perinatal asphyxia (46). Perinatal asphyxia was correlated with hyperglycemia during labor, 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 (17).

### 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 (39, 47, 48). Nearly one-third of large (at least 4 kg) neonates born to women with type 1 diabetes have an increased incidence of shoulder dystocia. Cesarean delivery without labor often is recommended in diabetic pregnancies if the fetal weight is estimated to be greater than 4300 - 4500g (47), contributing to the high rate of operative delivery for women with diabetes. Ultrasound parameters are not always accurate in predicting macrosomia (32).

### 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.

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## 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
- ❖ Preconception and prenatal maternal hemoglobin A1c levels
- ❖ Results of screening, diagnosis, and treatment of gestational diabetes and genetic evaluations
- ❖ Antenatal fetal surveillance results
- ❖ Monitoring during labor and status of lung maturation

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 (from 25 - 40%) (36, 49, 50, 51). 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. 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 (50, 52, 53).

Blood glucose values in the first 2 to 3 hours after birth may drop to low levels and then rapidly and spontaneously improve (50, 54). 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 (50).

### Signs and Symptoms of Infant Hypoglycemia

Symptoms of hypoglycemia are highly variable. Up to 50% of cases of hypoglycemia in infants will be asymptomatic (36). Consequently, routine screening is recommended for all infants of women with diabetes. Common symptoms of hypoglycemia in the neonate include (36, 54):

- ❖ 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**

While treatment, as discussed below, 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 age, 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 (55).
- ❖ 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 (50). Due to lethargy, feeding difficulties and need for optimal intake, it may be necessary to gavage feed 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  $<40$  mg/dl, parenteral treatment may be indicated (49).

### **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 (55). 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 (56).
- ❖ Do not delay treatment awaiting lab confirmation of hypoglycemia (54).
- ❖ 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 (36). The lowest serum calcium concentration typically occurs between 24 and 72 hours after birth and often is associated with hyperphosphatemia. The extent of hypocalcemia is related to the severity and duration of maternal diabetes.

Hypocalcemia is thought to be caused by the lower concentration of parathyroid hormone (PTH) after birth that is observed in neonates of diabetic mothers (57). Higher serum ionized calcium concentrations in utero may suppress the fetal parathyroid glands (57). The development of hypomagnesemia, prematurity, and birth asphyxia may be contributing factors. 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**

Hypomagnesemia, defined as serum magnesium concentration less than 1.5 mg/dl, occurs within the first three days after birth in up to 40% of pregnancies complicated by diabetes (36, 58). The mechanism is thought to be maternal hypomagnesemia, caused by increased urinary loss secondary to diabetes. Prematurity may 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 and PTH responsiveness (59). 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 dating (58). The mechanism may be delayed maturation of surfactant synthesis caused by hyperinsulinemia, possibly by interference with the induction of lung maturation by glucocorticoids (60, 61). In contrast, fetal lung maturation may occur early in diabetic pregnancies stressed by vasculopathy. To ensure lung maturity in diabetic pregnancies when elective delivery is planned, phosphatidylglycerol should be present in amniotic fluid and the ratio of lecithin to sphingomyelin (L/S ratio) should be more than 2.0, or optimally 3.5 (62).

Respiratory distress may also be due to hypertrophic cardiomyopathy, (63) other cardiac or pulmonary anomalies, or transient tachypnea of the newborn (TTN) (64, 65). 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 (66). The newborn will exhibit tachypnea within the first two hours of birth (67). 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 (67). Cesarean delivery for fetal macrosomia increases the risk of developing TTN (68).

### **Polycythemia and Hyperviscosity Syndrome**

Polycythemia, defined as a central venous hematocrit of more than 65, has been observed in 13% to 33% of infants born to women with diabetes (36, 64, 69). 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 (34, 35).

Polycythemia may lead to hyperviscosity syndrome, which includes vascular sludging, ischemia, and infarction of vital organs. Hyperviscosity is thought to contribute to the increased incidence of renal vein thrombosis seen in neonates of women with diabetes. Polycythemia also contributes to the increased, but rare, incidence of stroke, seizures, and necrotizing enterocolitis, renal thrombosis, and renal failure (36, 69). 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 (36).

### **Hyperbilirubinemia**

Hyperbilirubinemia occurs in 25 to 50% of infants of diabetic women (36, 59). It is associated with poor maternal glycemic control, and macrosomic infants are at highest risk (70). 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.

The Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study (27) reports that the incidence of hyperbilirubinemia increases as maternal glucose levels increase. Large for gestational age infants of

diabetic mothers may be at a greater risk for hyperbilirubinemia (20, 70). In one study, peak serum bilirubin concentrations were significantly higher in LGA infants of women with diabetes when compared to those who were average for gestational age or control infants (20).

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 (71, 72). It is most likely to occur in mothers with poor glycemic control during pregnancy. These changes have been reported to occur in up to 30% of all infants of diabetic mothers (72, 73). 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 (74).

Diagnosis is best made by echocardiogram. This condition is transient and rapidly resolves as insulin concentrations normalize (36, 72). The newborn is often asymptomatic. However, approximately 5% will exhibit congestive cardiac failure and there have been a few fetal deaths reported in the literature (74, 75, 76).

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 (77). Supportive care includes intravenous fluid administration, ventilatory support, correction of any metabolic conditions, and beta-blockers (36).

**Small Left Colon Syndrome**

Small left colon syndrome presents with abdominal distention, failure to pass meconium, and bile-stained vomiting (36). The problem is transient and usually resolves after the evacuation of the colon (78). Diagnosis is made with water-soluble contrast enema radiographic studies, 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 (36, 78).

**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. This complication usually resolves with conservative and supportive management that includes careful fluid and electrolyte management to treat any hypertension (64). Subspecialty consultation is recommended.

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**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 (25, 41, 79). The lifelong risk of developing diabetes averages about 6% in offspring of diabetics, 5% in their siblings, and 30% in their identical twins (versus 0.4% in subjects with no family history) (80, 81, 82). The development of type 1 diabetes is more likely in offspring of diabetic fathers than mothers (6.1% versus 1.3%) (83, 84). The development of type 2 diabetes is also influenced by genetic susceptibility. If the mother or father of an infant has type 2 diabetes, the infant's lifetime risk for developing diabetes is five to ten times higher than that of age- and weight-matched infants without a family history (82, 84, 85).

The abnormal metabolic environment of a diabetic pregnancy affects the development of type 2 diabetes and predisposing risk factors such as obesity (7, 41, 79, 86). 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 (41, 87). Intrauterine exposure to hyperglycemia and hyperinsulinemia affects the development of adipose tissue and pancreatic beta cells, leading to future obesity and altered glucose metabolism (41). 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 (24.6 versus 20.9 kg per m<sup>2</sup>). Impaired glucose tolerance has been documented in 36% of offspring of diabetic mothers, an abnormality associated with elevated amniotic fluid insulin concentrations (88). 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 (89).

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 29% in the average weight offspring of women with GDM, and 4.8% in the average weight offspring of nondiabetic mothers (7).

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 (90, 91).

### **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 (10, 12, 92). In contrast, poorly controlled diabetes may result in neurodevelopmental abnormalities in the offspring (12, 93). In one study, for example, head circumference at three years of age was negatively correlated with A1c levels during pregnancy (12, 93, 94). 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 (10). IUGR and central nervous system damage and malformations also contribute to developmental delays.

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## **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 widely accepted as beneficial for parents' postnatal psychological adjustment because they are prepared for the outcome (95). 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 (96). 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 (97).

Women who make the decision to terminate an intended pregnancy when faced with results showing fetal abnormalities experience grief reactions similar to those experienced by women with spontaneous pregnancy losses (98). 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 (99).
- ❖ Attend to and validate the complexity of parents' reactions and emotional responses (100).
- ❖ 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 the **Cultural Competency Chapter (Ch 10)** chapter for additional information.
- ❖ Support for breastfeeding, if the infant's condition permits, should be provided. Refer to the **Breastfeeding Chapter (Ch 8)** of this manual for more information.

Refer to the Behavioral and **Psychosocial Components of Care Chapter (Ch 9)** 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 (101). 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 (102). Care coordination with the family's pediatrician is another preventive measure with long-term positive implications for disease management.



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▶ *CDAPP Sweet Success*  
*Guidelines*  
*for Care*

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Chapter 6

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Exercise



*Sweet Success*

California Diabetes and Pregnancy Program

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# 6 Exercise

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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, 4). Regular, aerobic activity can be a useful tool for improving glycemic control by increasing insulin sensitivity (5, 6). 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.

	<b>Benefits</b>	<b>Potential Risks</b>
<b>Maternal</b>	<ul style="list-style-type: none"> <li>◆ Increases insulin sensitivity (7, 8)</li> <li>◆ Increases glucose utilization (6)</li> <li>◆ Improves carbohydrate utilization (7)</li> <li>◆ Increases and maintains muscular strength (8)</li> <li>◆ Increases and maintains cardiovascular conditioning (4, 5, 8)</li> <li>◆ Facilitates recovery (4)</li> <li>◆ Augments a general sense of well being (1, 4, 5, 9)</li> <li>◆ Fosters positive behavior and lifestyle changes (7)</li> <li>◆ Reduces back pain (4)</li> <li>◆ Improves mild to moderate hypertension (8)</li> <li>◆ May prevent excess weight gain (4)</li> <li>◆ Reduces risk of preeclampsia (10, 11)</li> </ul>	<ul style="list-style-type: none"> <li>◆ Increases hypoglycemia (4, 5)</li> <li>◆ Blood pressure increases may exacerbate preexisting long term complications (8)</li> <li>◆ Potential for musculoskeletal injuries (4, 8)</li> <li>◆ Increases preterm labor in those with a history of preterm births (3)</li> </ul>
<b>Fetal</b>	<ul style="list-style-type: none"> <li>◆ May reduce the risk of delivery of LGA due to GDM (6)</li> </ul>	<ul style="list-style-type: none"> <li>◆ Increases fetal bradycardia (4)</li> </ul>

---

**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 (1, 2, 12):

- ❖ 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 fetus, and increased perfusion of others 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 (13) - cardiac output increases approximately 40% during pregnancy (reaching a maximum at 20-24 week's 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. For this reason, supine positions should be avoided as much as possible during rest and exercise (14).

- ❖ **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 flow (4, 14), a fall in systemic vascular resistance (15), and an increase in systolic blood pressure in the third trimester (16). Furthermore, several studies indicate supine positioning decreases venous return from the lower extremities (15) 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 (5).



- ❖ **Fetal Responses to Maternal Exercise**

A rise of 10 to 30 beats per minute over baseline in fetal heart rate is characteristic during or after strenuous maternal exercise (14). Deceleration in fetal heart rate and bradycardia has been reported to occur approximately 8-9% of the time during maternal exercise. No associated lasting effects on the fetus have been reported (14). Likewise, no adverse fetal developmental effects from exercise have been reported in normal and insulin-requiring gestational diabetic pregnancies (17, 18).

### **Metabolic Changes**

The work of breathing during pregnancy increases 10% to 20% due to the pressure of the expanding uterus on the diaphragm, resting oxygen consumption (12). As the uterus expands, it displaces the diaphragm, which often creates discomfort and dyspnea, both at rest and during exercise (19). During pregnancy, resting oxygen requirements and increased work of breathing are caused by pressure from the enlarged uterus on the diaphragm. This results in decreased availability of oxygen during aerobic exercise (14, 19). A pregnant woman needs to modify the intensity of her activity to compensate for this decreased oxygen availability, and should be instructed to stop exercising before the point of exhaustion (20, 21).

A pregnant woman's body compensates for the increased demand of exercise. During exercise, plasma is filtered from the capillaries, resulting in an increased concentration of oxygen-laden red blood cells in the circulation. This also increases oxygen availability to the fetus (20).

The exercise-related increase in oxygen consumption during nonweight-bearing exercise, such as stationary cycling or swimming, is the same or greater in the second and third trimester as compared with postpartum (22). After the thirteenth week of pregnancy, daily energy requirements gradually increase to approximately 300 extra calories per day to meet the metabolic needs of pregnancy. This requirement is further increased for a pregnant woman who exercises regularly (18).

Exercise helps to regulate glucose transport and intracellular metabolism, while maintaining insulin sensitivity (5, 12). We maintain blood glucose level consciously 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 homeostasis (23):

- ❖ Growth Hormone stimulates cells to enlarge and divide and promotes 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 make the new glucose from non-carbohydrate sources, amino acids and glycerol from triglycerides. Cortisol has wide spread effects throughout the body including maintaining blood pressure and muscle strength (23).
- ❖ Glucagon from the pancreas, stimulates the liver to decompose stored glycogen into glucose when blood glucose levels drop. Glucogenolysis 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 the metabolism of sugar, protein and fat throughout the body.
- ❖ Somatostatin, also made by the pancreas, controls the glucose metabolism by inhibiting secretions of insulin and glucagons.
- ❖ Epinephrine/Norepinephrine from the adrenal glands, helps stimulate the heart, lungs, blood vessels and nervous system, and promotes processes to increase blood glucose levels when there is a demand for more energy.

Furthermore, exercise regulates hepatic glucose output (5). 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 (7). The impairment in the mobilization of liver glycogen stores, common during pregnancy (12), 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 (5, 17). 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 (14). 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 ligaments (particularly in the pubic symphysis and sacroiliac joints) (14)
- ❖ Cartilaginous softening
- ❖ Shifting of the center of gravity resulting in lumbar lordosis and potential balance problems (14)

The postural changes and the joint loosening often result in lower back pain (14). Women should routinely perform exercises to strengthen the back and abdominal muscles to prevent or relieve symptoms. The anatomical and physiological changes that occur during pregnancy have the potential to affect the musculoskeletal system (16). Due to joint laxity women should be cautious when stretching to avoid hyperextension of 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 (17, 21).

## Thermoregulatory Changes

- ❖ Maternal Thermoregulatory Control  
A pregnant woman's core body temperature increases when exercise is intense and/or of long duration (14, 22). It also rises faster in hot and humid environments. Pregnant women who are accustomed to exercise are better adapted to dissipating heat than women who have been sedentary. The level of hydration affects the increase in temperature during exercise, and a woman's core temperature is greater if the exercising woman is underhydrated (22). 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 regarding the effects of exercise on fetal temperature are limited. Fetal body core temperatures are about 1°C higher than maternal temperature (14).

### Decrease in Exercise Performance During Pregnancy

Because of the physiologic changes brought about by pregnancy, many women who exercise regularly may notice a progressive decline in performance beginning in early pregnancy (24). This decline is related to changes in aerobic capacity, pregnancy-related fatigue, nausea, vomiting and maternal morphologic changes. Most of these factors are related to cardiovascular, metabolic, musculoskeletal blood flow and heat production changes that occur during the third trimester (16).

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#### PRE-EXERCISE EVALUATION

The pre-exercise evaluation should include (5):

- ❖ 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 exercise prescription requires knowledge of potential risks and assessment of the physical ability to engage in various activities. The overall health, obstetric history, and medical risks should be evaluated before a woman is prescribed an exercise program (14).

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 is needed to prevent hypoglycemia.

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

Type	<ul style="list-style-type: none"> <li>◆ Suggest any aerobic activities that uses large muscle groups suited to the individual patient including light exercises and/or calisthenics to improve muscular strength and tone (25). Refer to <b>Appendix A</b> (page 19)</li> <li>◆ Avoid high intensity exercise, competitive activities or exercise in hot, humid environments if conception is suspected.</li> <li>◆ For weight loss, encourage low impact activities. Choose or modify exercise based on complications, if present.</li> </ul>
Frequency	◆ Encourage exercise 3 - 7 days a week on at least 3 non-consecutive days for improved glycemic control (19, 26).
Duration	◆ 20 - 60 minutes continuous or accumulated in sessions of at least 10 minutes at a time to a total of 150 minutes per week (26). For additional benefits such as weight loss, up to 300 minutes per week is recommended (26).
Intensity	<ul style="list-style-type: none"> <li>◆ Aim for 50 - 80% of heart rate reserve</li> <li>◆ Heart rate should always be correlated with ratings of perceived exertion for a more accurate indication of exercise intensity in the absence of an exercise tolerance test (2). 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 (27).</li> </ul> <p>Strength and flexibility training are also an important aspect of a complete fitness program and should be incorporated into a weekly fitness program.</p>
Resistance Training	◆ 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 (26).
*after medical clearance	

### Exercise During Pregnancy

A pregnant woman with preexisting diabetes or one who develops GDM can exercise with appropriate education and planning (14, 28). It is recommended that a pregnant woman with diabetes be provided an individualized exercise prescription (22). 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 signs (14).

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, [Appendix A](#) outlines 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.

<b>Table 3. PRENATAL EXERCISE GUIDELINES FOR A WOMAN WITH DIABETES</b>	
Type	<ul style="list-style-type: none"> <li>◆ Women should choose aerobic activities that will minimize the risk of loss of balance and fetal trauma, such as: brisk walking, stationary cycling, cross-country skiing, swimming, and arm ergometry for an upper body workout. Avoid high impact or excessively jarring exercises and contact sports (2, 26).</li> <li>◆ Exercise in the supine position should be avoided after the first trimester (individual differences may apply) (26).</li> <li>◆ Both aerobic and strength conditioning exercises are encouraged in all pregnant women without complications as part of a healthy lifestyle (2)</li> <li>◆ Women who have been exercising prior to pregnancy may continue their exercise program throughout pregnancy, using the guidelines in the following sections (2).</li> </ul>
Frequency	<ul style="list-style-type: none"> <li>◆ ACOG recommends that pregnant women engage in 30 minutes or more of moderate exercise on most, if not all, days of the week (13).</li> <li>◆ For previously sedentary women, start with at least 15 minutes of continuous exercise 3 times per week, gradually increasing to at least 30 minutes per day of accumulated moderate intensity physical activity to a total of 150 minutes per week (2).</li> </ul>
Duration	<ul style="list-style-type: none"> <li>◆ Do not exercise to exhaustion (20). Exercise should include a 5 - 10 minute warm-up and a cool-down period (5, 26).</li> </ul>
Intensity	<ul style="list-style-type: none"> <li>◆ Moderate activity is appropriate. Additionally, women who regularly engage in vigorous-intensity aerobic activity or high amounts of activity can continue their activity provided that their condition remains unchanged (e.g. they are in glycemic control) and they talk to their health care provider about their activity level throughout their pregnancy. <a href="http://www.health.gov/PAGUIDELINES/factsheetprof.aspx">http://www.health.gov/PAGUIDELINES/factsheetprof.aspx</a></li> </ul>
In type 1 diabetes, exercise does not always improve glycemic control (5).	

Exercise can play a significant role in improving glycemic control during pregnancy, particularly for women with GDM and is generally recommended. At the end of this section we will summarize precautions and contraindications (3, 17). 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). Exercise also helps to control weight gain in a woman with GDM (2). 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 which describes blood glucose values and carbohydrate needs for physical activity during pregnancy.

<b>Table 4. BLOOD GLUCOSE VALUE AND CARBOHYDRATE NEEDS FOR PHYSICAL ACTIVITY DURING PREGNANCY FOR WOMEN WITH PREEEXISTING DIABETES</b>	
<b>Blood Glucose Level</b>	<b>RECOMMENDED TREATMENT</b>
> 250 mg/dl	Check urine ketones. If positive do not exercise until ketones are negative (8).
100 - 250 mg/dl	No extra food; blood glucose above 130 mg/dl at 1 hour after a meal is outside Sweet Success goals (8). Call doctor for exercise advice.
<100 mg/dl	Eat a pre-exercise carbohydrate snack (8)
< 60 mg/dl	Treat for hypoglycemia; start exercise after blood glucose is at target level (25).

### 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 callisthenics or simply the 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 (29).

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). 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 (30).

CDAPP goals for blood glucose control during pregnancy are:

fasting	60-89 mg/dl
one hour postprandial	100-130 mg/dl (plasma values) (31)

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 (19, 32).

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 try to time exercise 30-60 minutes after eating a meal. This may help to blunt the postprandial glucose response provided blood glucose values are within target range (33).

Recreational activities with an increased risk of falling such as gymnastics, horseback riding, or ice hockey, and vigorous racquet sports that have a high risk of abdominal trauma should be avoided, particularly in the third trimester. Scuba diving should be avoided throughout pregnancy. Other activities such as soccer and basketball, with a potential for contact can place the mother and fetus at risk for trauma (13). Avoid exercising during peak periods of insulin action and in extreme heat, humidity, or cold (5).

❖ 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 the recommended amount of carbohydrates 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, if the woman feels well and urine and/or blood ketones are negative, it is not necessary to postpone exercise based simply on hyperglycemia (34).

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 (doubles), jogging, cycling, or playing golf 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.

- ♦ Eat a meal 1 - 3 hours before exercise (8).
- ♦ In women taking insulin, extra carbohydrate should be ingested if pre-exercise blood glucose levels are < 100 mg/dl (34).
- ♦ Take supplemental carbohydrate (about 20 - 25 g) every 30 minutes during exercise if activity is vigorous and of long duration > 60 minutes (8).
- ♦ After prolonged exercise, > 60 minutes, decrease in blood glucose levels may occur several hours after exercise or may remain lowered for 12-18 hours (3). This may require a decrease in intermediate-acting insulin or additional snacks several hours later (8).

### **Precautions and Safety Considerations**

A woman with any of the following conditions needs to be evaluated carefully to determine whether an exercise program is appropriate for her (14).

- ❖ Poorly controlled type 1 diabetes
- ❖ Poorly controlled thyroid disease (26)
- ❖ Cardiac disease
- ❖ Vascular disease

- ❖ Chronic hypertension
- ❖ Pulmonary disease
- ❖ Renal disease (4)
- ❖ Anemia (2, 30)
- ❖ Eating Disorder (2)
- ❖ Previous spontaneous abortion (2)
- ❖ Previous preterm birth (2)
- ❖ Morbid obesity (BMI > 33) (14)

Many of the above conditions, if well controlled, are not obstacles to regular physical activity.

#### Symptoms that Signal a Time to Stop Exercising

A pregnant woman should be advised to stop exercising immediately and call their doctor, if one or more of the following symptoms occur (2, 13):

- ♦ Vaginal bleeding
- ♦ Painful uterine contractions
- ♦ Unexplained abdominal pain
- ♦ Severe tachycardia
- ♦ Loss of muscle control
- ♦ Dizziness
- ♦ Nausea
- ♦ Chest pain
- ♦ Severe breathlessness
- ♦ Headache
- ♦ Calf pain or swelling
- ♦ Decreased fetal movement
- ♦ Amniotic fluid leakage

#### Absolute Contraindications

Certain maternal and/or fetal conditions preclude exercise.

- ♦ Pregnancy-induced hypertension (2)
- ♦ Intrauterine growth restriction (14)
- ♦ Preterm rupture of membranes (2, 13)
- ♦ Preterm labor (14)
- ♦ Incompetent cervix or cerclage (13, 14)
- ♦ Persistent second or third trimester bleeding (4, 13, 14, 35)
- ♦ Diagnosed retinopathy (14)
- ♦ Multiple gestation at risk for premature labor (14)
- ♦ Placenta previa after 28th week (2, 14)

#### 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. Many physiologic and morphologic changes of pregnancy continue up to 4-6 weeks postpartum (14, 24).
- ❖ 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 (36).
- ❖ 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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**APPENDICES**

A - Suggested Strengthening Exercises for a Pregnant Woman with  
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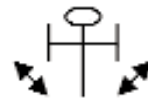


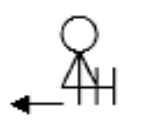





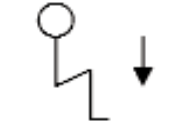

B - Appropriate Modes of Exercise for Pregnancy Complicated by  
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C - Little Changes Make a Big Difference ..... 21



## Appendix A

## Suggested Strengthening Exercises for a Pregnant Woman with Diabetes

-  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.

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**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.

---

**Appendix C**

<b>LITTLE CHANGES MAKE A BIG DIFFERENCE *</b>		
<b>Little Change</b>	<b>Daily Calorie Expenditure or Deficit</b>	<b>Annual Weight Loss (lbs)</b>
Climb one extra flight of stairs	5	0.5
Walk in your neighborhood until you find a penny (10 minutes)	50	3.9
Manually operate your TV	6	0.6
Pull 10 weeds from your garden	10	1.0
Park 100 extra yards away from your work entrance	5	0.5
Walk one minute after each meal	15	1.5
Rise up and stretch 5 times at work	8	0.8
Walk 8 extra minutes a day	40	4.0
Cut your own lawn twice a month *	400	2.3
Give up your evening candy or ice-cream treat during TV news	200	10
One less doughnut per week	200	2.8
One less ice-cream cone per week	200	2.8
<b>Total weight loss:</b>		<b>29.8</b>

Adapted from A Turner, MS. Handout for clients, 2000.

\* If you are pregnant, check with your health care provider before starting an exercise and/or weight loss program.

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▶ *CDAPP Sweet Success*  
*Guidelines*  
*for Care*

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Chapter 7  
Medical Nutrition  
Therapy

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*Sweet Success*  
California Diabetes and Pregnancy Program

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# 7 Medical Nutrition Therapy

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# 7 Medical Nutrition Therapy

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## 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 prenatal outcomes (1, 2), and is a key component of glycemic control. 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, 5, 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 goals (7) (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).

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## MEDICAL NUTRITION THERAPY FOR PREGNANCY AFFECTED BY DIABETES

MNT includes:

- ❖ 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
- ❖ Maintain normal renal status
- ❖ Differentiate between insulin deficient ketosis (Type 1 diabetes) and carbohydrate/calorie deprivation ketosis
- ❖ 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 RD:

- ❖ 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 either religious, cultural or philosophical

<b>Table 1. COMPONENTS OF A NUTRITION ASSESSMENT (9)</b>		
<b>Clinical Data</b>	<b>Psychosocial History</b>	<b>Dietary History</b>
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**

The recognition of the importance of maternal health before pregnancy has led to a growing interest in preconception and interconception care (11). Women with a chronic health condition, such as diabetes or weight problems, should receive ongoing care per clinical guidelines for their evaluation, treatment, and follow-up during the preconception and interconception periods. Nutritional status can be addressed in each of the four basic components of preconception and interconception care:

1. risk assessment (eg, BMI, dietary intake)
2. health promotion (eg, folate supplementation)
3. clinical interventions (eg, calorie-restricted diet, exercise program)
4. psychosocial interventions (eg, behavior modification strategies) (12).

Refer to the [Medical Management and Education for Preexisting Diabetes \(Ch 3\)](#) chapter for a description of the CDAPP model of diabetes preconception care. This model can be used for interconception care as well.

### **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 at least one HbA1c within target range just before attempting to become pregnant (14). 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 Table 1 in the [Medical Management and Education for Preexisting Diabetes \(Ch 3\)](#) section of these Guidelines.

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 (15). 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. Preconception and pregnancy nutrition counseling, careful prenatal management, tight monitoring of weight gain, and long-term follow-up could minimize social and economic consequences (16).

Maternal overweight and obesity increase the risk of birth defects, pregnancy complications, and adverse pregnancy outcomes (17, 18). In women with a prior pregnancy with GDM, having a prepregnancy weight >190 lb in a subsequent pregnancy increased the risk of a recurrence of GDM by 70% (19, 20). Modest increases in BMI before pregnancy could result in an increased risk for GDM and perinatal complications, even if a woman does not become overweight (21). Therefore, preconception counseling for women with preexisting diabetes and prior GDM should address the issue of weight management.

Achieving an ideal body weight is unrealistic for many women (10). Achieving a reasonable body weight may be a more appropriate goal. 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 (22).

### **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 in Table 2 for 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. Exposure to undernutrition during the periconceptional period may be inconsistent with good pregnancy outcomes (23). It is recommended that weight reduction plans are discontinued before attempting to conceive a pregnancy to assure optimal intake of nutrients prior to conception. Maintaining an adequate diet well in advance of pregnancy will also help to avoid a disruption of blood glucose control as a result of large changes in dietary composition in early pregnancy (14).

**Table 2. CALCULATING PRECONCEPTION KILOCALORIE NEEDS (9, 24)**

The Institute of Medicine recommends a research-based energy intake calculation using the following estimated energy requirement (EER) formula:		
<b>14 - 18 years of age:</b>		
$\text{EER} = 135.3 - (30.8 \times A) + \text{PA} \times (10.0 \times \text{Wt} + 934 \times \text{Ht})$		
<b>19 Years and older:</b>		
$\text{EER} = 354 - (6.91 \times A) + \text{PA} \times (9.36 \times \text{Wt} + 726 \times \text{Ht})$		
A = age (years)		
PA = physical activity coefficient		
Wt = weight (kg)		
Ht = height (meters)		
<b>Physical Activity</b>	<b>14 - 18 yrs</b>	<b>PA 19 yrs +</b>
Sedentary (only light physical activity associated with typical day-to-day life)	1.0	1.0
Moderate Active (lifestyle includes daily 30 minutes of moderate intensity physical activity)	1.16	1.12
Active (lifestyle includes daily 60 minutes of moderate intensity physical activity)	1.56	1.45
<b>Sample calculation for estimated energy requirement (EER)</b>		
Reference <i>normal weight</i> woman is 55 kg, 165 cm, 20 years old, little or no strenuous activity		
$\begin{aligned} \text{EER (kcal)} &= 354 - (6.91 \times 20) + 1.0 \times (9.36 \times 55 + 726 \times 1.65)^* \\ &= 354 - 138.2 + 1.0 \times (514.8 + 1197.9) \\ &= 216 + 1.0 \times 1713 \\ &= 1929 \text{ kcal} \end{aligned}$		
* REMINDER: In any math formula (outside of and within parentheses), all multiplication steps are completed before addition and subtraction.		

**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 nausea, vomiting or hypoglycemia. Major changes in diet composition may disturb glycemic control and are not recommended in the first trimester (3). In the second and third trimesters, daily energy requirements gradually increase. See Table 3 to calculate energy needs in pregnancy.

**Table 3. ENERGY NEEDS FOR PREGNANCY BASED ON GESTATIONAL AGE**

The Institute of Medicine formulas for Estimating the Energy Requirements (EER) for pregnant women who have **normal weight** are as follows:

- 1st trimester = Adult EER + 0
- 2nd & 3rd trimester = Adult EER + (8 x gestational age) + 180 kcal

At this time there is no consensus on determining energy requirements for **overweight and obese** pregnant women. A registered dietitian should evaluate each individual's case and provide the necessary education and monitoring to achieve weight gain goals (Table 5). Some women, especially those who are sedentary and/or live in developed countries, may not need the additional kilocalories recommended above.

Kilocalorie needs for a pregnant woman with diabetes vary depending on her BMI, activity level, age, whether the pregnancy has single or multiple fetuses, pregravid weight and other factors (13). The goal is to meet nutrition and energy requirements for normal fetal growth with appropriate maternal weight gain. Energy needs may require adjustment during pregnancy based on blood glucose values, ketone levels and weight gain parameters (25). Additional kilocalorie recommendations for specific populations are also mentioned in Table 3.

**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 (26). Tracking prenatal weight gain is the recommended method of determining if caloric intake is adequate. Proposed weight gain recommendations are found in Table 6. Consistent weight gain with 1.5 lb per week after the first trimester appears to reduce the risk of preterm and low birth weight deliveries (26).

**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 4. Also refer to **Appendix A** for a Body Mass Index Table.

<b>Table 4. CALCULATING BODY MASS INDEX *</b>	
<p>To calculate BMI using U.S. imperial units:  <math display="block">\text{BMI} = 703 \times \frac{\text{Weight (lb)}}{\text{Height (in)}^2}</math> <b>Example:</b> 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:  <math display="block">\text{BMI} = \frac{\text{Weight (Kg)}}{\text{Height (meters)}^2}</math> <b>Example:</b> 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 (<b>Appendix B</b>). See BMI calculator link: <a href="http://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/english_bmi_calculator/bmi_calculator.html">http://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/english_bmi_calculator/bmi_calculator.html</a></p>	

**BMI Cut-Offs**

BMI cut-off points are used clinically to identify individuals for:

- ❖ absolute risk assessment
- ❖ determining the type and intensity of treatment
- ❖ monitoring individuals for effects of treatment over time
- ❖ determining institutional policies on individuals
- ❖ increasing awareness of risk for individuals (27)

Risk assessment for GDM should be done on all pregnant women at the first prenatal visit to determine the need for early testing. The American Diabetes Association recommends testing to detect diabetes for women with a pregravid BMI ≥25 or any of these additional risk factors (28):

- previous GDM,
- presence of glucosuria,
- diagnosis of Polycystic Ovary Syndrome,
- women of ethnic groups with a high prevalence of diabetes diabetes (African American, Latino, Native American, Asian American, and Pacific Islander)
- first-degree relative with diabetes



- previous delivery of large-for-gestational age infant
- chronic use of medication that may affect blood glucose levels

The criteria of BMI  $\geq 25$  for early screening by CDAPP is notably lower than the BMI  $>29$  which was the cut-off point for obesity according to the 1990 Institute of Medicine (29). In 2002 CDAPP adopted a combination of the 1990 Institute of Medicine (IOM) and World Health Organizations (WHO) BMI cut-offs points. In 2009 the IOM adopted the WHO cut-off points for categorizing prepregnancy BMI for the general population. With the new 2009 IOM BMI cut-offs for the general population, a BMI of  $\geq 30$  is considered obese instead of a BMI of  $>29$ . The underweight BMI category was also adjusted from  $<19.8$  to  $<18.5$  (see Table 5). The 2009 cut-off changes affect the upper and lower ends of the weight categories by allowing overweight women to weigh more before being classified as obese and thin women to weigh less before being classified as underweight. With each BMI cut-off, different pregnancy weight goals apply.

Weight Category	2009 IOM BMI	Recommended Total Weight Gain Ranges	Rate of Weight Gain (lb/wk) 2nd & 3rd Trimester
Underweight	$< 18.5$	28 - 40 lbs	1 - 1.3 lbs
Normal	18.5 - 24.9	25 - 35 lbs	0.8 - 1 lbs
Overweight	25.0 - 29.9	15 - 25 lbs	0.6 lbs
Obese	$\geq 30.0$	11 - 20 lbs	0.5 lbs.

There are currently no specific IOM BMI cut-offs for women with diabetes. 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. For methods to establish and plot weight and height see [Appendix B](#).

### **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 (31, 32, 33, 34). Lower amounts of gestational weight gain may be more

appropriate for women with insulin resistance, 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 5).

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.

Moderate caloric reduction of 30% of energy needs in obese women with GDM may improve glycemic control without ketonemia and reduce weight gain (35). 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 (36, 37).

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 (31, 38, 39). There is a possibility that thin women with BMI 18.5 to 19.7 will not be encouraged to gain the full 28-40 lbs now that underweight is defined as BMI <18.5. 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 (27). Several Asian subgroups have been identified as particularly at risk for GDM (40). Asian American ethnicity is recognized by the American Diabetes Association (41) and CDAPP as a risk factor for GDM. The WHO BMI cut-off points for Asian populations suggest an overweight category at BMI 23-27.4 and obese category at > 27.5. 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 (42).

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 (39).

### **Monitoring Weight Gain**

Use the appropriate weight gain grid to monitor weight gain (see [Appendix C](#)). 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. Consuming excessive amounts of salt can also contribute to fluid retention and undesirable weight gain. The meal plan should be carefully reevaluated for all nutrients as well as kilocalories (25).

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 (25).

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 due to a decrease in carbohydrate intake (43). 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 (30). BMI-specific weight gain recommendations have been proposed by the Institute of Medicine (30) and Luke, et al (44). The Institute of Medicine notes that the sample size for underweight (BMI <18.5) was insufficient to make a recommendation (30). 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 (44). In addition, the timing of weight gain is important: appropriate weight gain prior to 28 weeks of pregnancy strongly contributes to birth weight (44).

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 (45). See Table 6 for weight gain recommendations found in the literature for twin gestations.

<b>Table 6. RECOMMENDED WEIGHT GAIN DURING TWIN PREGNANCY</b>			
Weight Category	2009 Institute of Medicine		Rate of Weight Gain (lb/wk after 20 wks)
	Pre gravid BMI	Weight Gain Recommend.	
Underweight	No recommendation		1.75 lbs
Normal weight	18.5 - 24.9	37 - 54 lb	1.5 lbs
Overweight	25 - 29.9	31 - 50 lb	No recommendation
Obese	≥ 30	25 - 42 lb	No recommendation

#### **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. During this time, it is important to develop a meal plan that meets the nutrition guidelines for diabetes in early pregnancy so that only minor dietary adjustments are needed during the first trimester (14). 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 7.

Kilocalories	<p><b>Preconception:</b> 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 in <a href="#">Table 2</a>.</p> <p><b>Pregnancy:</b> 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 Women (<a href="#">46</a>) is a guide for recommended amounts of food for pregnant women and may not be suitable for all individuals. Strong scientific evidence suggests that the energy cost of pregnancy is less than previous theoretical estimations (<a href="#">47</a>). Energy estimates must be individualized based on a nutrition assessment, physical activity and weight gain patterns in pregnancy.</p>
Protein	<p><b>Preconception:</b> The Recommended Daily Allowance (RDA) is 0.8g/kg/day</p> <p><b>Pregnancy:</b> Requirements <u>do not</u> 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 (<a href="#">24</a>).</p>
Carbohydrate	<p><b>Preconception:</b> The contributions of CHO to energy intake should be individualized based on nutrition assessment, metabolic profiles, and treatment goals.</p> <p><b>Pregnancy:</b> The RDA is a minimum of 175g CHO/day (<a href="#">24</a>).</p>
Fat	<p><b>Preconception and Pregnancy:</b> Less than 7% of energy intake should be derived from saturated fats and &lt;1% trans fats (<a href="#">48</a>). 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. See <a href="#">Appendix D</a>.</p>
Nonnutritive Sweeteners	<p><b>Preconception and Pregnancy:</b> Consumption of acesulfame potassium, aspartame, saccharin, sucralose, and neotame within acceptable daily intakes (ADI) is safe during pregnancy (<a href="#">49</a>). Stevia-derived sweeteners, including stevia glycosides and rebaudioside A (Reb A), are on the Generally Recognized as Safe (GRAS) list (<a href="#">30</a>) 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 (<a href="#">50</a>).</p>
Fiber	<p><b>Preconception and Pregnancy:</b> Adequate Intake (AI) of total fiber for women under 50 years is 25 g/day (<a href="#">24</a>). 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 (<a href="#">51</a>) Fiber also is effective for relief of constipation as long as it is coupled with adequate fluid intake.</p>
Sodium	<p><b>Preconception and Pregnancy:</b> 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 (<a href="#">52</a>).</p>

Folic Acid	<p><b>Preconception:</b> 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 (53). 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 (54, 55).</p> <p><b>Pregnancy:</b> RDA recommendation is that women should consume 600 mcg/day of dietary folate equivalents (53). 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><b>Preconception:</b> RDA for iron is 18 mg/day.</p> <p><b>Pregnancy:</b> 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 (54). For women taking supplements &gt;30 mg/day of iron, 15 mg of zinc and 2 mg of copper as supplements are recommended (56). These amounts are found in many prenatal vitamin-mineral supplements.</p>
Calcium	<p><b>Preconception:</b> 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><b>Pregnancy:</b> UL is 3000 mg/day for ages 14 - 18 years; 2500 mg/day for ages 19 - 50 years ; and 2000 mg/day for greater than 50 years of age (57).</p>
Magnesium	<p><b>Preconception:</b> RDA for ages 14 - 18 years is 360 mg; ages 19 - 30 years is 310 mg; and ages 31 - 50 is 320 mg (58).</p> <p><b>Pregnancy:</b> 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 (58).</p>
Vitamin D	<p><b>Preconception:</b> RDA is 600 IU (15 mcg)/day and UL is 4000 IU (100 mcg)/day (57).</p> <p><b>Pregnancy:</b> Same as preconception above.</p>
Multivitamin and Mineral Supplements	<p><b>Pregnancy:</b> 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 (47). Vegans need to supplement their diet with 600 IU Vitamin D and 2.0 mcg Vitamin B12.</p>
Herbal & Botanical Supplements	<p><b>Pregnancy:</b> Pregnant women should be advised to consider herbal treatments as suspect until their safety during pregnancy can be ascertained. Limit herbal teas (59). To keep abreast of new information consult The Academy of Nutrition and Dietetics and go to the American Pregnancy web site (59, 60).</p>
Alcohol	<p><b>Preconception:</b> Avoid if planning pregnancy. May reduce fertility (61).</p> <p><b>Pregnancy:</b> No alcohol. A safe level of alcohol intake has not been established for any stage during pregnancy.</p>

<b>Table 7. DIETARY CARE GUIDELINES FOR PRECONCEPTION AND PREGNANCY, continued</b>	
Caffeine	<p><b>Preconception:</b> Some evidence suggests high levels (&gt; 500mg/day) may delay conception (62).</p> <p><b>Pregnancy:</b> Some adverse effects on pregnancy outcomes have been linked to high caffeine intakes. Prudent advice would be to discourage &gt;200 mg caffeine/day (i.e. limit to two 6 ounce cups of coffee/day) (63).</p>
Twin Gestations	Micronutrient and macronutrient supplementation specific to the physiology of twin gestations, and carbohydrate controlled diets are recommended for optimal twin growth and pregnancy outcome (64, 65).
<p><b>Acronyms:</b></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 docosahexanoic acid (DHA), elcosapentaenoic 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 (66).

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.



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 (67).

At [www.epa.gov/waterscience/fish/advice](http://www.epa.gov/waterscience/fish/advice), the Environmental Protection Agency (EPA) recommends “following these three recommendations for selecting and eating fish or shellfish, women and young children will receive the benefits of eating fish and shellfish and be confident that they have reduced their exposure to the harmful effects of mercury.

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. For California, local advisories can be found at the California Office of Environmental Health Hazard Assessment (OEHHA), [www.oehha.ca.gov/fish/preg/index.html](http://www.oehha.ca.gov/fish/preg/index.html). OEHHA states that “women who are pregnant or might become pregnant, nursing mothers, and young children should consume no more than one meal per week of locally caught fish, and when no other advice is available, eat no other fish that week”.

The safety of fish oil supplements is not yet established, and cannot be routinely recommended during pregnancy (66). Therefore, a food based approach is recommended to improve the omega-3 fatty acid profiles during pregnancy. For dietary sources of fatty acids see [Appendix D](#).

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## MEAL PLAN DESIGN

### Meal Plan Recommendations

Throughout pregnancy, placental hormones and cytokines such as human placental lactogen, progesterone, prolactin, cortisol, and TNF- $\alpha$  continue to increase (68). The increasing levels of these hormones and cytokines cause changes in metabolism and blunts the effectiveness of insulin to lower blood glucose levels (14, 69). 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 (35). Carbohydrates are carefully spaced among several meals and snacks (70). 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 (71). 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 (72).

To manage the increased carbohydrate sensitivity seen during pregnancy and achieve euglycemia, carbohydrate intake may be kept at 40 - 45% of kilocalories per day (43). The total daily carbohydrate levels and distribution should be individualized to tolerance and preference. A suggested initial carbohydrate distribution is depicted in Appendix E. The minimum carbohydrate level in the second and third trimester of pregnancy is 175 grams per day (24). 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 (73). 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.

- ❖ 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 (43).
- ❖ 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 (74, 75). Therefore, the breakfast carbohydrate load may need to be restricted to 15 - 30 grams of carbohydrate (51).
- ❖ Fruit juices, fruits, milk, ready-to-eat or instant cereals, bagels, croissants and rice porridge are usually excluded from the breakfast meal. Self blood glucose monitoring 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 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 (76).
- ❖ Allow no more than 10 hours between bedtime snack and breakfast the following morning (72).
- ❖ 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 (77, 78, 79).

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 ADA 2007 Clinical Practice Recommendations state that, “For individuals with diabetes 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” (35).

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 (80).

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

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. See Appendix F for GI and GL values of selected foods.

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**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 [Preexisting Diabetes: Medical Management and Education \(Ch 3\)](#) for more information regarding insulin resistance and duration of insulin action.

**Glyburide and Meal Planning**

Since the landmark study of Langer et al, (81) 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 (82). 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. See [Appendix G](#) for sample snacks.

**Metformin**

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

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## 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 (83). 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, please refer to the CDAPP Sweet Success Resource and Training Center website:

<http://www.CDAPPSweetSuccess.org>

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## 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 (84). Based on the previously recommended 3 hour OGTT, a study by Langer and colleagues (85) 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 preeclampsia and caesarean sections were also higher in women with one abnormal glucose value (86, 87). 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 (1). Similarly, the Academy of Nutrition and Dietetics nutrition practice guidelines for GDM utilized by registered dietitians in obstetric clinics resulted in improved prenatal outcomes (2).

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.

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## 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 pre and post meal 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 (88). 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 8. 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.

<b>Outcome</b>	<b>Process</b>
Adequate nutrient intake	Review food records for adequate nutrient intake to meet the Daily Reference Intakes ( <i>DRI</i> ) (formerly RDA). The California MyPlate for Gestational Diabetes can be used to educate patients regarding sufficient nutrient intake. Refer to <a href="#">Appendix H</a> .
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 (i.e. skipped meal or snack, excessive insulin dose, or extra exercise).

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



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**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 (89). Additionally, limiting saturated fats to no more than 7% and trans fats to no more than 1% of the total fat intake is helpful in controlling dyslipidemia (90).

**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 (91). 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 a week of making dietary changes. The DASH diet averages 6 servings of grains, 4 servings of fruits, 4 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 (92).

**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 (93). 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 bariatric surgery in patients with gestational diabetes was not associated with adverse perinatal outcomes (94). 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.

Women who have had bariatric surgery and are considering pregnancy should ideally have preconception nutritional assessment and counseling. Laboratory data will assist in this assessment and if there are deficiencies they are best corrected early in the pregnancy. Ideally, the time to correct nutritional problems is preconception, making pregnancy planning the most sensible approach. Those who have had bariatric surgery should already be taking a multivitamin, preferably in a liquid or chewable form, to enhance absorption and avoid obstruction. Prenatal vitamins should be given in addition to the women's usually prescribed vitamin and mineral supplementation and not instead of that supplementation. Post stabilization, patients can usually ingest as little as 1200 kcal/day. Therefore, wise selection of protein, carbohydrates and healthy fats is imperative. Vitamins and minerals of particular importance during pregnancy after bariatric surgery are (95, 96):

- ◆ **Calcium:** Post bariatric women many require 1,200-1,500mg of calcium 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 (95, 96).

- ♦ **Folic Acid:** Adequate folate absorption becomes a matter of concern for post bariatric surgery. Foods high in folic acid such as lentils, asparagus, spinach, broccoli, peanuts, orange juice, enriched breads and cereals may not be well tolerated and also many bypass the duodenum. Serum blood levels should be measured to verify this nutritional need is being met (95, 96). Homocysteine may be the most sensitive marker of folic acid status in conjunction with erythrocyte folate (97). Supplementation of 800 - 1000 mcg/day folic acid will treat and/or prevent a deficiency. Greater than 1000 mcg/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:** Malabsorption and decreased nutritional intake may also cause iron deficiency post surgery. Iron in the form of ferrous fumarate, at a dose of 40 to 64 mg, is best tolerated because the iron has already been broken down from the ferric state making absorption more effective. Restrictive bariatric surgery patients may not require as much iron supplementation, but periodic hemoglobin levels should be taken to verify sufficiency (95, 96).
- ♦ **Vitamin B12:** Vitamin B12 absorption is greatly affected by the malabsorptive form of bariatric surgery due to lack of intrinsic factor. Deficiencies may result in elevated serum homocysteine levels that are related to early pregnancy loss. Women should be encouraged to take 500 mcg of Vitamin B12 daily in the crystalline form. Serum cobalamin levels should be periodically drawn to ensure Vitamin B12 intake is sufficient (98).
- ❖ **General Guidelines for Post Bariatric Surgery**

There are no standardized nutritional guidelines for bariatric surgery (99). However, here are some recommended general guidelines that pertain to pregnant women who have had bariatric surgery.

  - ♦ Protein should be preferentially eaten before fats and carbohydrates, ideally 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 feeling of satiety to occur.
  - ♦ Food should be well chewed and should be eaten in small volumes.
  - ♦ 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 is a rapid method for the RD to assess whether the woman is knowingly or unknowingly restricting her intake of kilocalories and/or carbohydrate (35).

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, urine ketone testing is not routinely recommended unless there is persistent weight loss or a particular need to identify whether the woman is consuming adequate kilocalories and/or carbohydrates (100).

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. Diabetic ketoacidosis (DKA) (101) consists of the biochemical triad of hyperglycemia, ketonemia and acidemia, and can occur with blood glucose levels as low as 180 to 200mg/dl in pregnancy. DKA in pregnancy is usually associated with type 1 diabetes but there have been cases of DKA diagnosed in women with GDM as well (102, 103 104). 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. Refer to the [Medical Management and Education for Preexisting Diabetes During Pregnancy Chapter \(Ch 3\)](#) for more information.

### **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 (105).
- ❖ 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. 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).
- ❖ Women with type 1 diabetes may be advised to test for urine ketones every 4 hours or until negative (106).
- ❖ 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 180-200 mg/dL for more than 4 hours (103, 107), or urine ketones are moderate to large or blood ketones are >0.6 mmol/L (106).
- ❖ Insulin therapy should continue but insulin doses often need to be adjusted during this time.
- ❖ 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.

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## POSTPARTUM NUTRITION ISSUES

### Postpartum Nutritional Issues for Women with GDM

Five to 10 percent of women who have had GDM will develop type 2 diabetes right after pregnancy. Women who have had GDM have a 20 to 50 percent chance of developing diabetes in the 5 to 10 years after the pregnancy (43, 108).

The children of women with a history of GDM are also at an increased risk for obesity and diabetes (109).

Type 2 diabetes may be prevented through lifestyle changes. In the Diabetes Prevention Program, study participants lost 5 to 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 (110). For early detection, it is crucial that women who have had GDM have an annual screen for diabetes (111).

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, MyPlate 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.

### **When Breastfeeding is Not Possible**

For postpartum women who cannot breastfeed:

- ❖ Protein intake can be reduced to 0.8 gm/kg (about 46 gm protein/day)
- ❖ Carbohydrate intake can be reduced to 130 gm/day
- ❖ Iron intake can be reduced to 18 mg/day for women 19-50 years of age
- ❖ Calcium intake should remain the same – 1000 mg/day
- ❖ Calorie restricted diets as low as 1200 kcal/day are acceptable with a multivitamin mineral supplement
- ❖ Folic acid supplementation should be continued at 400mcg daily

### **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. Insulin resistance, coupled with the added burden of pregnancy, leads to the inability of pancreatic beta cells to maintain glucose homeostasis and ultimately results in hyperglycemia (112).

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.
- ❖ A minimum of 30 minutes of exercise every day
- ❖ If overweight, lose at least 5-10% of current weight
- ❖ Maintain A1C values < 6.5%

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## 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 the **Breastfeeding Chapter (Ch 8)**. Nutrition requirements for a woman during lactation following a diabetic pregnancy are discussed below. Whether a woman chooses to breastfeed or not, she will need nutritional guidance and a MNT plan during the postpartum period to meet her changing needs (9).

The energy requirements of lactating women are met primarily from the diet (24) but may also be met by the mobilization of tissue stores. 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 lb/month (113). A folic acid supplement with 400 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 to maintain adequate milk production. The RDA for protein is the same for diabetic and non-diabetic women; which is 1.1 g/kg/day or +25 g/day of additional protein over non-pregnant requirements (24). 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 (24).

Table 9 summarizes recommendations for healthy eating while lactating.

<b>Table 9. GENERAL SUGGESTIONS FOR HEALTHY EATING WHILE LACTATING</b>	
❖	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 to 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 non fat dairy products such as fat free milk, 1% milk, part-skim mozzarella cheese and non fat 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 400 mcg of synthetic folic acid daily, in addition to a diet rich in natural folate.



### **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. Rapid weight loss greater than 4.5 pounds or 2 kg per month is generally not recommended for a breastfeeding woman (114). 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 (25). Suggested bedtime snack should contain the following:

- Carbohydrate: 1-2 exchanges (15-30 grams)
- Protein: 1-2 exchanges (7-14 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, late hyperglycemia, increased insulin response (115), 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 and acesulfame-K cross into breast milk (113). Aspartame does not cross into the breast milk (11). 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. 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 7). A woman who has phenylketonuria (PKU) or whose infant has PKU, should not use aspartame as a nonnutritive sweetener.

### Supplements

The Dietary Reference Intake of iron for mothers 18 years or less is 10 mg/day. For mothers 19-50 years, 9 mg/day are recommended (116). 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 (116). 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 child bearing 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 (117). 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 keep abreast of new information consult <http://ods.od.nih.gov/>.

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Appendix A

		Body Mass Index Table																																			
		Normal					Overweight					Obese					Extreme Obesity																				
BMI	Height Inches	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
		Body Weight (pounds)																																			
58	91	96	100	105	110	115	119	124	129	134	138	143	148	153	158	162	167	172	177	181	186	191	196	201	205	210	215	220	224	229	234	239	244	248	253	258	
59	94	99	104	109	114	119	124	128	133	138	143	148	153	158	163	168	173	178	183	188	193	198	203	208	212	217	222	227	232	237	242	247	252	257	262	267	
60	97	102	107	112	118	123	128	133	138	143	148	153	158	163	168	174	179	184	189	194	199	204	209	215	220	225	230	235	240	245	250	255	261	266	271	276	
61	100	106	111	116	122	127	132	137	143	148	153	158	164	169	174	180	185	190	195	201	206	211	217	222	227	232	238	243	248	254	259	264	269	275	280	285	
62	104	109	115	120	126	131	136	142	147	153	158	164	169	175	180	186	191	196	202	207	213	218	224	229	235	240	246	251	256	262	267	273	278	284	289	295	
63	107	113	118	124	130	135	141	146	152	158	163	169	175	180	186	191	197	203	208	214	220	225	231	237	242	248	254	259	265	270	278	282	287	293	299	304	
64	110	116	122	128	134	140	145	151	157	163	169	174	180	186	192	197	204	209	215	221	227	232	238	244	250	256	262	267	273	279	285	291	296	302	308	314	
65	114	120	126	132	138	144	150	156	162	168	174	180	186	192	198	204	210	216	222	228	234	240	246	252	258	264	270	276	282	288	294	300	306	312	318	324	
66	118	124	130	136	142	148	155	161	167	173	179	186	192	198	204	210	216	223	229	235	241	247	253	260	266	272	278	284	291	297	303	309	315	322	328	334	
67	121	127	134	140	146	153	159	166	172	178	185	191	198	204	211	217	223	230	236	242	249	255	261	268	274	280	287	293	299	306	312	319	325	331	338	344	
68	125	131	138	144	151	158	164	171	177	184	190	197	203	210	216	223	230	236	243	249	256	262	269	276	282	289	295	302	308	315	322	328	335	341	348	354	
69	128	135	142	149	155	162	169	176	182	189	196	203	209	216	223	230	236	243	250	257	263	270	277	284	291	297	304	311	318	324	331	338	345	351	358	365	
70	132	139	146	153	160	167	174	181	188	195	202	209	216	222	229	236	243	250	257	264	271	278	285	292	299	306	313	320	327	334	341	348	355	362	369	376	
71	136	143	150	157	165	172	179	186	193	200	208	215	222	229	236	243	250	257	265	272	279	286	293	301	308	315	322	329	338	343	351	358	365	372	379	386	
72	140	147	154	162	169	177	184	191	199	206	213	221	228	235	242	250	258	265	272	279	287	294	302	309	316	324	331	338	346	353	361	368	375	383	390	397	
73	144	151	159	166	174	182	189	197	204	212	219	227	235	242	250	257	265	272	280	288	295	302	310	318	325	333	340	348	355	363	371	378	386	393	401	408	
74	148	155	163	171	179	186	194	202	210	218	225	233	241	249	256	264	272	280	287	295	303	311	319	326	334	342	350	358	365	373	381	389	396	404	412	420	
75	152	160	168	176	184	192	200	208	216	224	232	240	248	256	264	272	279	287	295	303	311	319	327	335	343	351	359	367	375	383	391	399	407	415	423	431	
76	156	164	172	180	189	197	205	213	221	230	238	246	254	263	271	279	287	295	304	312	320	328	336	344	353	361	369	377	385	394	402	410	418	426	435	443	

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**Appendix B****Methods for Establishing Pregravid Weight****I Prepregnant Weight**

For a standardized method of collecting prepregnant weight, please use the following guidelines:

1. CHECK FOR PREPREGNANT WEIGHT, WHICH IS KNOWN TO BE MEASURED
  - Check weight record. For women who were followed in your organization during preconception, check preconception weight records. (In this situation, the reviewer has strong reason to believe that the recorded weight has been measured). Use the measured prepregnant recorded weight that is closest to the woman's last menstrual period. See "Other Considerations" for use of ultrasound dating.
2. CHECK FOR OTHER PREPREGNANT WEIGHT IN MEDICAL CHARTS
  - Use prepregnant recorded weight that was obtained elsewhere (or you are not sure of how it was obtained). Use the recorded weight from medical records with a prepregnant weight that is closest to the woman's last menstrual period, but no later than two weeks after the last menstrual period.
3. HAVE PATIENT RECALL PREPREGNANT WEIGHT
  - Interview the woman. Some women are keenly aware of their weight at all times. Interview the woman about her weight status using wording such as "just before getting pregnant with this most current pregnancy." Be aware that some women will quote a prepregnant weight from a previous pregnancy, so it is important to use specific wording for this question. If the woman had regular periods, ask, "What was your weight at your last menstrual period?"
4. ESTIMATE WEIGHT
  - **Review antepartum records.** For women with gestational diabetes, evaluate antepartum records.
  - **Check records at first prenatal visit.** If the recorded weight is from the early half of the trimester, the weight may be close to the actual prepregnant weight.
  - **Discuss weight changes in pregnancy.** Changes in weight perceived by the women before the prenatal appointment can be discussed and documented during the initial Sweet Success interview. Another question to help elicit a response is, "Did your clothes size change between now and when you first got pregnant?"

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**Appendix B,  
Continued**

- **Adjust for perceived weight changes.** The woman's perceived weight change can be noted and used to adjust the current weight to approximate the prepregnant weight. Ask the woman if she gained any weight after getting pregnant "this time," and ask if she gained weight before her first prenatal appointment. For example. In the first trimester, if the woman states that she lost 5 pounds after becoming pregnant, add 5 pounds to the current weight to approximate the prepregnant weight.
- **Interview patient about any discrepancies.** Interviewing the patient may help resolve the weight status discrepancy. Has the woman reported inaccurately or has she really gained 50 pounds in the first 18 weeks? Eating habits will need to be evaluated and the reliability of the woman's reporting needs to be assessed. Consider the discrepancy between "reported" prepregnant weight and "estimated" prepregnant weight. Use weight data from the first prenatal visit and evaluate if the pounds gained could be possible, given the pregnancy weight of gestation, and the eating and exercise habits of the woman.
- **Use professional judgment.** Establishing prepregnant weight may require a professional judgment made by the interviewer. For example, if the woman states that she weighed 130 pounds just prior to getting pregnant this time, yet her actual weight at her first prenatal visit, at 18 weeks gestation, is 180 pounds, there will be some question about the accuracy of the prepregnant weight.

**II Prenatal Weight**

Determine the woman's weight at every visit. To obtain an accurate weight:

1. make sure the scale is placed on firm flooring (tile or wood, not carpet).
2. have the woman remove shoes and heavy clothing (coats, jackets, sweatshirts, etc.).
3. make sure the woman stands with both feet in the center of the scale.
4. Record the woman's weight to the nearest decimal fraction (e.g. 155.5).

**III Prenatal Height**

At her first visit, measure the woman without shoes. Be sure her heels, buttocks and shoulder blades (three points of contact) are against the wall or surface and she is standing up straight and looking forward, with her head erect and not touching the wall surface.

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**Appendix B,  
Continued****IV Other Considerations**

- Height status should always be measured.
- Weight recorded on a driver's license is often inaccurate.
- Ultrasound dating of gestational age done during early pregnancy is a tool to establish weeks of gestation. Once weeks gestation is established, work backward through dates and check the woman's weight status at any office visit near the early half of the trimester of pregnancy. If the woman has not weighed in early pregnancy, a weight measured within three months before the estimated conception can be used as a prepregnant weight. This is true as long as the woman was not on a weight reduction meal plan prior to conception, and as long as infertility medications were not being used.
- Women who discontinue smoking prior to or during pregnancy may experience weight fluctuations.
- Women following a weight loss meal plan at the time of conception may gain extra weight more quickly when switched to a meal plan that is adequate for pregnancy.
- Fertility medications taken before and during pregnancy can cause weight gain that is not consistent with expected early pregnancy weight gain.
- Women who discontinue physical activity or exercise prior to or during pregnancy may experience weight gain.

**V Instruction for Charting\*** (the 0 axis represents the prepregnant weight)

1. Determine which pattern of weight gain (normal, under, over, or obese) is appropriate based on the woman's prepregnancy weight for height (BMI). Each time a current weight measurement is available:
2. Determine the number of pounds gained or lost by comparing the current weight with the prepregnancy weight.
3. Determine the week of gestation on the date of current weight
4. Place a dot on the grid where the line representing the number of pounds gained or lost crosses the line representing the weeks of gestation.
5. Compare the change in weight between measurements with the gain expected for the estimated prepregnancy status (normal, under, over, or obese).
6. Consider the results of this assessment with the results of the dietary and clinical (physical/medical) assessment to determine appropriate recommendations. Discuss her weight gain progress.
7. Continue to plot and assess weight changes as future weight measurements are available.

\* If prepregnancy weight is unavailable see section 1.4 (Methods for Estimating Pregravid Weight) above.

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Appendix C1

**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

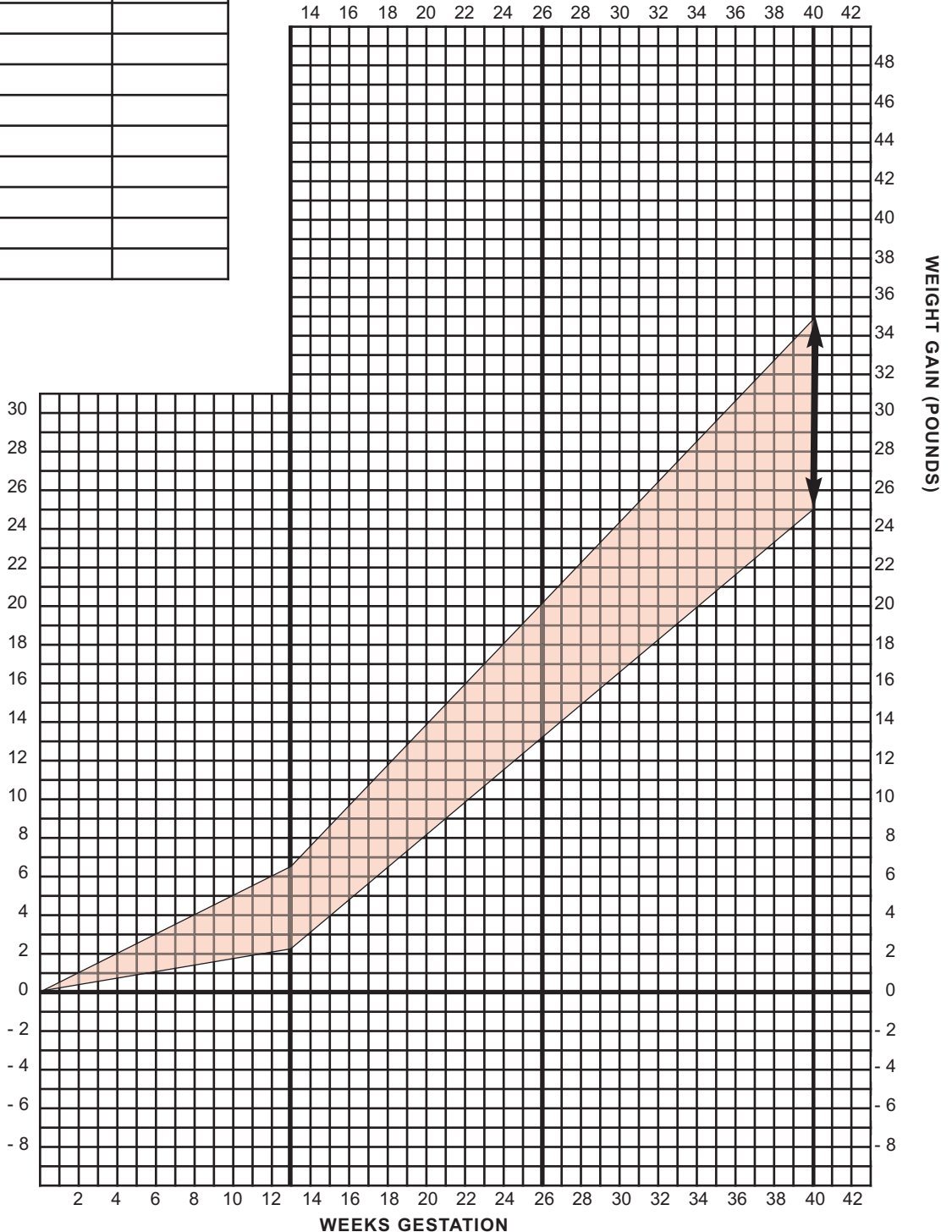
Height	Under Weight (BMI < 18.5)	Normal Weight (BMI 18.5-24.9)	Over Weight (BMI 25-29.9)	Obese (BMI ≥ 30)
4'7"	<80	80-107	108-128	>128
4'8"	<83	83-111	112-133	>133
4'9"	<86	86-115	116-138	>138
4'10"	<89	89-119	120-143	>143
4'11"	<92	92-123	124-148	>148
5'	<95	95-127	128-153	>153
5'1"	<98	98-132	133-158	>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)<sup>2</sup> X 703

PREPREGNANCY

WEIGHT: \_\_\_\_\_

HEIGHT: \_\_\_\_\_



1 Per personal communication with the Committee to Reexamine IOM Prepregnancy Weight Guidelines.  
 2 IOM, 2009. Weight Gain During Pregnancy:Reexamining the Guidelines. Washington DC; National Academies Press.

Appendix C2

**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

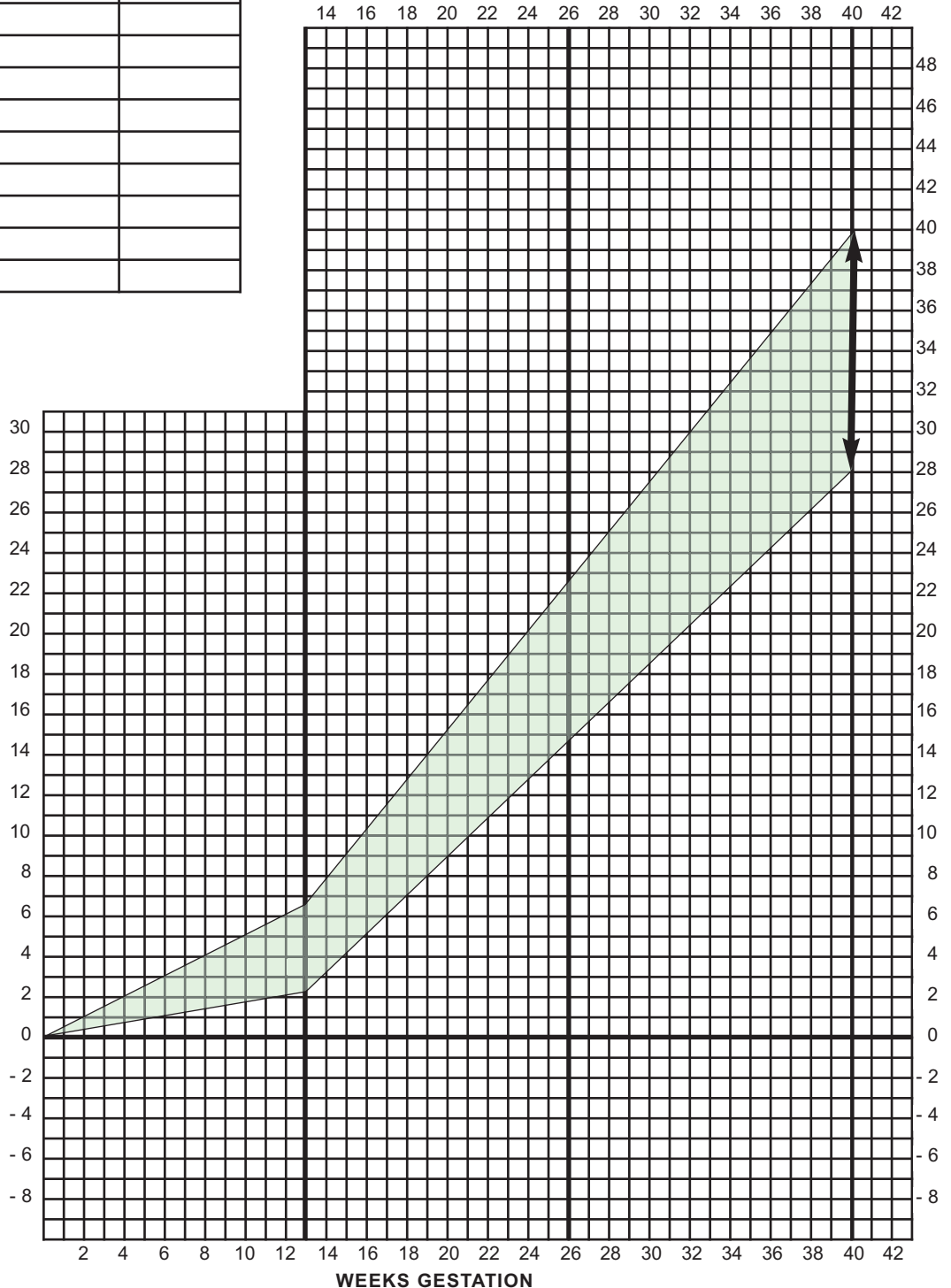
Height	Under Weight (BMI < 18.5)	Normal Weight (BMI 18.5-24.9)	Over Weight (BMI 25-29.9)	Obese (BMI ≥ 30)
4'7"	<80	80-107	108-128	>128
4'8"	<83	83-111	112-133	>133
4'9"	<86	86-115	116-138	>138
4'10"	<89	89-119	120-143	>143
4'11"	<92	92-123	124-148	>148
5'	<95	95-127	128-153	>153
5'1"	<98	98-132	133-158	>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)<sup>2</sup> X 703

PREPREGNANCY

WEIGHT: \_\_\_\_\_

HEIGHT: \_\_\_\_\_



1 Per personal communication with the Committee to Reexamine IOM Prepregnancy Weight Guidelines.  
2 IOM, 2009. Weight Gain During Pregnancy: Reexamining the Guidelines. Washington DC; National Academies Press.

**APPENDIX C3**

**PRE-PREGNANCY OVERWEIGHT RANGE**

**Prenatal Weight Gain Grid (1)  
Recommended Weight Gain (2): Single 15-25 lbs; Twins 31-50**

NAME: \_\_\_\_\_

EDC: \_\_\_\_\_

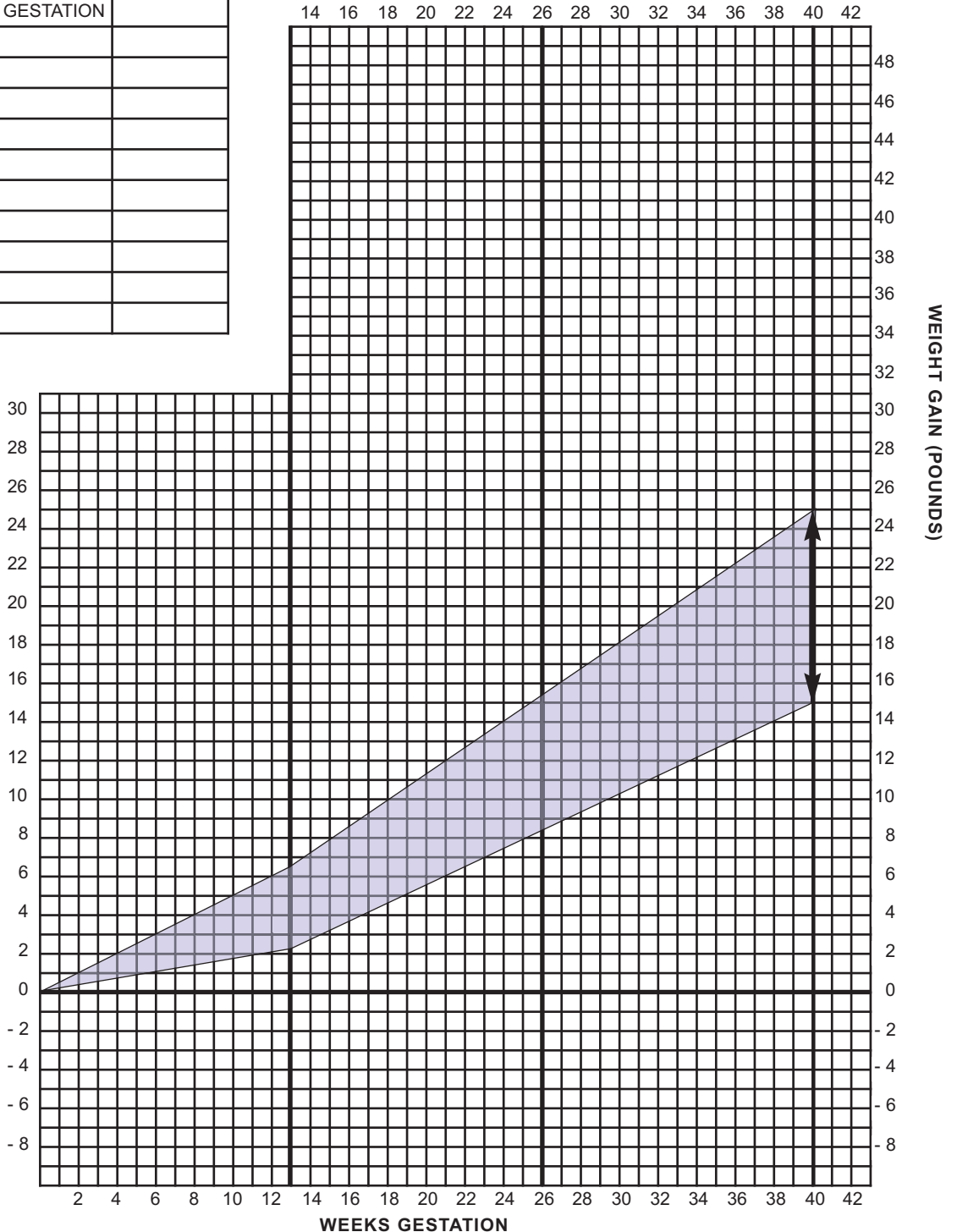
HEIGHT: \_\_\_\_\_

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	108-128	>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
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5'2"	<101	101-136	137-163	>163
5'3"	<105	105-140	141-169	>169
5'4"	<108	108-145	146-174	>174
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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)<sup>2</sup> X 703



1 Per personal communication with the Committee to Reexamine IOM Prepregnancy Weight Guidelines.  
2 IOM, 2009. Weight Gain During Pregnancy: Reexamining the Guidelines. Washington DC; National Academies Press.

Appendix C4

**PRE-PREGNANCY OBESE WEIGHT RANGE**

Prenatal Weight Gain Grid (1)  
 Recommended Weight Gain (2): Single 11-20 lbs; Twins 25-42

NAME: \_\_\_\_\_

EDC: \_\_\_\_\_

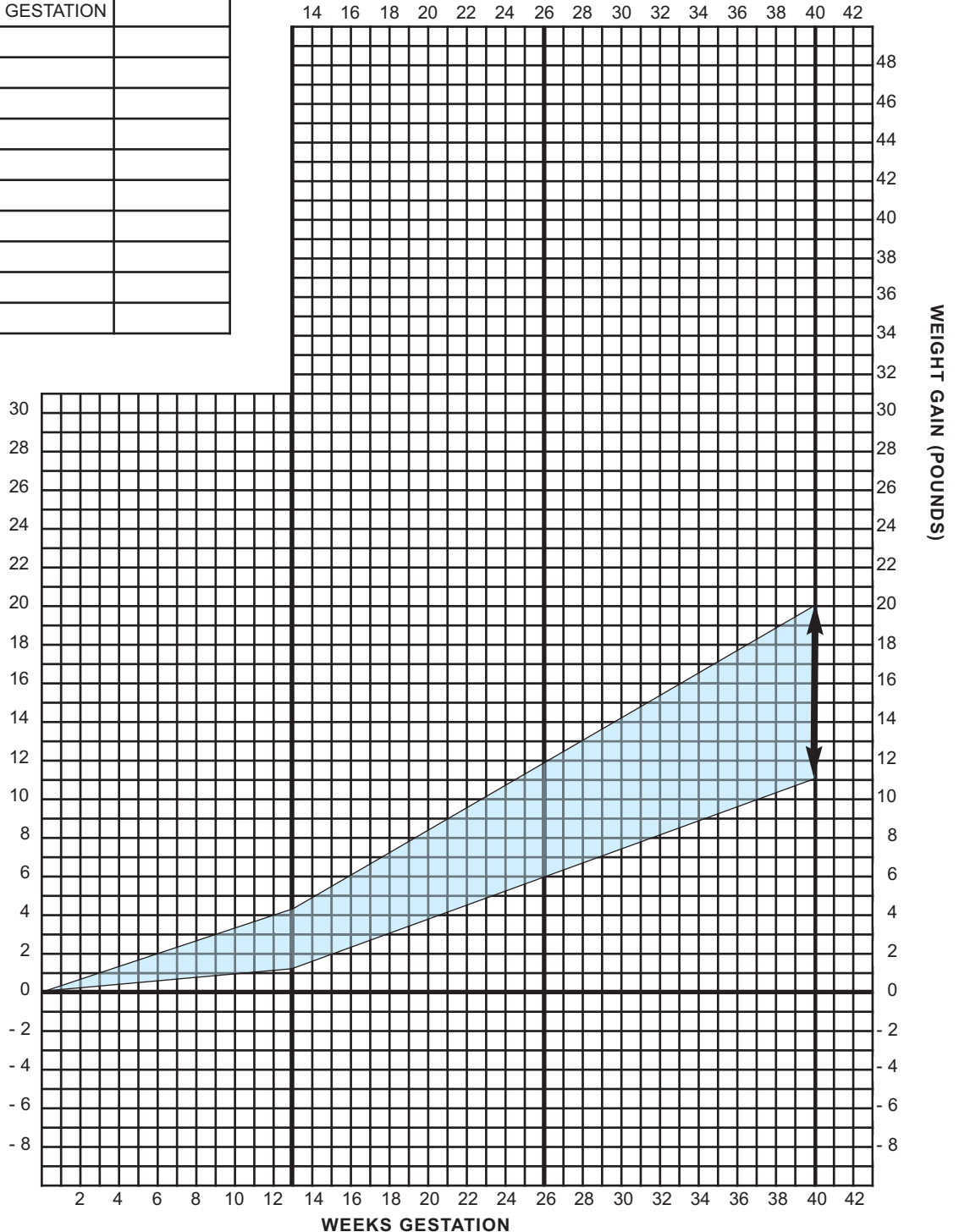
HEIGHT: \_\_\_\_\_

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"	<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)<sup>2</sup> X 703



1 Per personal communication with the Committee to Reexamine IOM Prepregnancy Weight Guidelines.  
 2 IOM, 2009. Weight Gain During Pregnancy: Reexamining the Guidelines. Washington DC; National Academies Press.



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**Appendix D**
**Omega-3 Fatty Acids**

The health benefits from omega-3 fatty acids have been well proven for disease prevention. While foods containing the precursor essential fatty acids, linoleic acid and alpha linolenic acid (see Table 1) are important contributors to long-chained polyunsaturated fatty acid status (AA, EPA and DHA), recent evidence points to preformed dietary DHA as a critical factor contributing to maternal levels during pregnancy.

In the human body the conversion of precursor essential fatty acids into AA, EPA and DHA is not very efficient and is actually inhibited by high intakes of vegetable oils (corn oil, soybean oil and other seed oils) and processed foods (trans fats). A dietary intake of preformed DHA and AA is preferential over supplements to meet the high demands of pregnancy and a daily source of alpha linolenic acid is recommended. Fish is the best source of preformed DHA but women who do not want to eat fish can look for vegetarian sources of DHA, such as fortified foods .

Another option is to take a supplement containing at least 200 mg of DHA. Several prenatal supplements include DHA, either from fish oil or other sources.

The safety of fish oil supplements has yet to be established and cannot be routinely recommended during pregnancy.

<b>Dietary Sources of Fatty Acids</b>			
	<b>Fatty Acid</b>	<b>Food Sources</b>	<b>Suggested Intake</b>
Precursor	Linoleic Acid (LA)	Vegetable oils (corn, soybean and other seeds)	Limit intake
Precursor	Alpha Linolenic Acid (ALA)	Walnuts, leafy vegetables, soy, and canola oils	Some animal studies have shown that flaxseed can be harmful during pregnancy. Little research has been done in humans. The safety of flaxseed (linseed) oil in pregnancy and lactation is under question and not currently recommended. Use the other food sources listed for ALA.
Preformed	Arachidonic Acid (AA)	Animal fats	Provides small amounts
	Eicopentasoic Acid (EPA)	Fish and shellfish, particularly fatty, deep water marine species*	12 oz/wk Fish (two to three 4-6 oz cooked portion sizes)
	Docosahexaenoic Acid (DHA)	Fish and shellfish, particularly fatty, deep water marine species*. Eggs from grass fed chickens. Fortified foods such as milk, juice, bread and yogurt	12 oz/wk Fish (two to three 4-6 oz cooked portion sizes)

\* Recommended fish as a source of DHA in pregnancy are salmon, striped bass, canned light tuna (limit albacore tuna and tuna steak to no more than 6 oz/wk), pollock, catfish, and anchovies. Large, predatory fish such as swordfish, shark, king mackerel and tilefish contain potentially high levels of mercury and should be avoided. Too much mercury may be harmful to the fetus' developing brain and nervous system.

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**Appendix E**
**Meal Plan Carbohydrate Distribution (in Grams)**

Daily Reference Intake (DRI) for carbohydrate in pregnancy = 175g

Space all meals and snacks 2 - 3 hours apart.						
<b>Step 1</b>	<b>Breakfast</b>	<b>Snack</b>	<b>Lunch</b>	<b>Snack</b>	<b>Dinner</b>	<b>Snack</b>
	30	30	45	30	45	30 = 210g CHO
<b>Step 2</b>	<b>Breakfast</b>		<b>Lunch</b>		<b>Dinner</b>	
	15	30	45	30	45	30 = 195g CHO
<b>Step 3</b>	<b>Breakfast</b>		<b>Lunch</b>		<b>Dinner</b>	
	15	30	30	30 - 15	30	30 = 180g CHO*
* Exercise and diet (with careful carbohydrate distribution) are always first line therapy for women with GDM or DM 2. If the patient cannot achieve optimal blood glucose control with Step 3 carbohydrate distribution, consider insulin and/or oral agent therapy.						

**Acceptable Macronutrient Range**

<b>kcal</b>	<b>Carbohydrate 40%</b>	<b>Carbohydrate 45%</b>
1800 kcal	180 g	202 g
1900 kcal	190 g	214 g
2000 kcal	200 g	225 g
2100 kcal	210 g	236 g
2200 kcal	220 g	248 g
2300 kcal	230 g	258 g
2400 kcal	240 g	270 g

**Appendix F****Glycemic Index and Glycemic Load  
Values for Selected Foods**

Food	Glycemic Index	Serving Size	Available Carbohydrate (g)	Glycemic Load per serving
Cornflakes	81	1 cup	40	21
Russet potato, baked	76	1 medium	30	23
Cherrios	74	30 g	20	14.8
White bread	73	1 large slice	14	10
Bagel	70	70 g	35	25
White rice, boiled	64	1 cup	36	23
Brown rice, boiled	55	1 cup	33	18
Sourdough wheatbread	54	30 g	14	7.6
Spaghetti, white boiled 10 to 15 min.	44	1 cup	40	18
Orange, raw	42	1 medium	11	5
Orange juice	42	4 oz.	11	4.6
Pinto beans, dried boiled	39	1 cup	26	10
All-Bran cereal	38	1 cup	23	9
Apples, raw	38	1 medium	15	6
Skim milk	32	8 fl. oz.	13	4
Lentils, dried boiled	29	1 cup	18	5
Cashew nuts	22	1 oz.	9	2
Peanuts	14	1 oz.	6	1

(Foster-Powell, K, Host, S, Brand-Miller, J. International table of glycemic index and glycemic load values: 2002. American Journal of Clinical Nutrition, 2002;16:5-56.)

**Glycemic Index Reference Range:**

High - 70-100  
 Medium - 50-69  
 Low - < 50

**Glycemic Load Reference Range:**

High -  $\geq 20$   
 Medium - 11-19  
 Low - 10

---

**Appendix G****SAMPLE SNACKS**

For many women, eating 3 meals and 3 snacks is a challenge. A common question is "What can I have for a snack?" Below are sample snack ideas. Remember to discuss what you have been eating and your blood sugar levels with your registered dietitian. The snack size may change.

**Sample Daytime Snacks:**

- ½ toasted english muffin with 1 Tbsp natural style peanut butter
- 1 quesadilla (1 small tortilla and 1 ounce cheese)
- 1 cup melon with ¼ cup cottage cheese
- 1 small apple (cut into slices) with 1 Tbsp natural-style peanut butter
- 2 Tbsp sunflower seeds and 2 Tbsp raisins
- ½ turkey or ham sandwich
- 6 saltine crackers with 1 ounce tuna

**Sample Bedtime Snacks:**

- 2/3 cup rice with 1 ounce meat, chicken or fish
- 1 small tortilla with 1 ounce meat and ½ cup beans
- 1 ham or turkey sandwich
- 1 cup sugar-free yogurt and ½ peanut butter sandwich
- 1 cup milk and ½ toasted English Muffin with melted cheese and sliced tomatoes
- 1 cup milk with a mini sandwich (1 ounce dinner roll and 1 ounce sandwich meat or cheese)

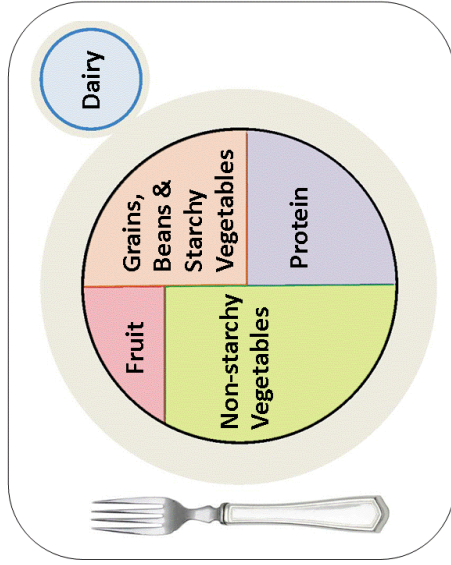
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# California

# MyPlate for Gestational Diabetes

When you are pregnant and have diabetes, you have special nutrition needs. Use MyPlate for Gestational Diabetes to help you manage your blood sugar. This will help keep you and your baby healthy. Every day, eat the number of servings/choices of food shown below. Talk to a registered dietitian (RD) to develop a meal and exercise plan that will meet your needs.

**⚠️ Limit Your Carbohydrates.** When you have gestational diabetes, the type and amount of carbohydrates matter. Vegetables, Grains, Fruits, and Dairy contain carbohydrates. Some have more and some have less. Eating too many or the wrong type of carbohydrate may raise your blood sugar. Avoid foods with added sugar or white flour, such as cookies, candy and soda.



## Vegetables

**Eat non-starchy vegetables.**

Use fresh, frozen or low-sodium canned vegetables.

For diabetes, starchy vegetables like potatoes, sweet potatoes, yams, peas, corn & winter squash count as a Grain, not a Vegetable.

### **Daily Amount**

- 6 or more of these choices:
- 2 cups raw leafy vegetables
- 1 cup raw vegetables
- 1/2 cup cooked vegetables



**5 grams (g)** carbohydrate per serving

## Protein

**Choose lean protein.**

Avoid bacon, hot dogs & bologna.

### **Daily Amount**

- 6 or more of these choices:
- 1 ounce fish, poultry, lean meat, or cheese
- 1/4 cup cottage cheese
- 1 egg
- 1 ounce nuts
- 1/2 cup tofu
- 2 Tablespoons nut butter



**0 g** carbohydrate per serving

## Grains

**For diabetes, beans & starchy vegetables count as Grains.**

Eat 100% whole grains. Avoid cold breakfast cereals. Avoid instant rice, noodles & potatoes.

### **Daily Amount**

- 7 of these choices:
- 1 slice whole wheat bread
- 1/2 cup potato or yam
- 1 small whole grain tortilla
- 1/2 cup cooked dried beans, non-instant cereal, corn or peas
- 1/3 cup cooked pasta, rice



**15 g** carbohydrate per serving

## Fruits

**Eat unsweetened fruits of all colors.**

Do not drink fruit juice. Avoid fruit at breakfast. Limit dried fruit to 1/4 cup a day.

### **Daily Amount**

- 2 of these choices:
- 1 small apple
- 17 small grapes
- 1 cup papaya
- 1/2 banana



**15 g** carbohydrate per serving

## Dairy

**Choose only pasteurized plain milk or yogurt.**

For diabetes, cheese is in the Protein group. Do not eat yogurt or drink milk at breakfast.

### **Daily Amount**

- 3 of these choices for women or
- 4 of these choices for teens:
- 1 cup 1% or fat free milk
- 1 cup soy milk with calcium
- 3/4 cup of plain yogurt



**15 g** carbohydrate per serving

## Fats & Oils

- Use healthy plant oils like canola, safflower & olive oil for cooking.
- Read labels to avoid saturated & trans fats (hydrogenated fats).
- Avoid solid fats such as lard, shortening & butter.

- Fish has healthy fats. Eat cooked fish at two meals each week.
- Limit oils to 6 teaspoons each day.

**0 g** carbohydrate per serving

# My Nutrition Plan for Gestational Diabetes

This is my plan until I meet with a registered dietitian (RD) for my personal meal and exercise plan.

**EVERY day, I will:**

- Eat 3 meals and 3 snacks, 2 to 3 hours apart.
- Eat my bedtime snack so that no more than 10 hours pass before I eat breakfast the next day.
- Drink plenty of fluids. I will choose caffeine-free, sugar-free beverages. I will limit coffee to 2 cups daily & not drink alcohol.
- Limit artificial sweeteners to 1 - 2 servings a day.
- Try to walk for 10 - 15 minutes after each meal, especially breakfast.

Include protein and carbohydrates at each meal and snack.

Eat at least 175 grams (g) of carbohydrates a day. For the amount of carbohydrates in one serving of food, see below:

◆ **Non-starchy Vegetables** = 5g ◆ **Protein** = 0g ◆ **Grains, Beans and Starchy Vegetables** = 15g ◆ **Fruit** = 15g ◆ **Dairy** = 15g

As a sample, meals may look like this:

**Breakfast**

**Eat 15g carbohydrates from the Grains group**

**Include:**

- ◆ 1-2 servings Protein
- ◆ unlimited servings of non-starchy Vegetables

Do not eat Fruit, yogurt or drink milk.

**Example of a breakfast:**  
One egg omelet with cheese & vegetables and one slice toast

**Lunch and Dinner**

0-1 serving Fruit

unlimited servings non-starchy Vegetables

0-1 serving milk or yogurt

2 servings Grains, beans or starchy vegetables

2-3 servings Protein

**Eat 45g carbohydrates, not including non-starchy vegetables**

- ◆ Choose only one serving fruit, milk or yogurt at lunch and at dinner

**Snacks**

**Eat 15g-30g carbohydrates from Fruit, Grains, or Dairy group**

**Include:**

- ◆ At least 1 serving Protein with every snack
- ◆ unlimited servings of non-starchy Vegetables

**Examples of snacks:**

- ◆ 1 small tortilla + 1 ounce cheese
- ◆ 2 rice cakes + celery + 2 tablespoons nut butter
- ◆ 1/2 banana + 24 almonds



---

***For more information:***

California Department of Public Health, Center for Family Health  
Maternal Child and Adolescent Health Division  
California Diabetes and Pregnancy Program (CDAPP) Sweet Success  
Guey-Shiang Tsay, RN, MSN  
(916) 650-0300

<http://www.cdph.ca.gov/programs/CDAPP>

or

California Diabetes and Pregnancy Program (CDAPP) Sweet Success  
Resource and Training Center  
Cynthia Peña, MPH, MSW  
(858) 536-5090

<http://www.CDAPPSweetSuccess.org>



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# ▶ *CDAPP Sweet Success* *Guidelines* *for Care*

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## Chapter 8

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## Breastfeeding



*Sweet Success*  
California Diabetes and Pregnancy Program

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# 8 Breastfeeding

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# 8 Breastfeeding

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## 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. 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 stated, “If 90% of US families could comply with medical recommendations to breastfeed exclusively for 6 months, the United States would save \$13 billion per year and prevent in excess of 911 deaths, nearly all of which would be infants (\$10.5 billion and 741 deaths at 80% compliance)” (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 (5). Multiple studies have shown that encouragement by health professionals increased breastfeeding initiation (6) and duration (7). One large national study found that women were four times more likely to initiate breastfeeding when they received encouragement from their providers (6). Such studies support using CDAPP 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. Initiation and continued breastfeeding for at least 4 months among women with DM1 was comparable to the background population. Cessation of breastfeeding was mainly due to common problems such as perceived low milk supply and was not related to diabetes status (4).

---

## GENERAL BREASTFEEDING EDUCATION GUIDELINES

General breastfeeding education for a woman with diabetes is similar to that for a woman 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.

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

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



The following suggestions for hospital policies, listed in Table 3, are adapted from Providing Breastfeeding Support: Model Hospital Policy Recommendations (8). This document was endorsed by the California Department of Public Health (CDPH) and recommended to all birthing hospitals in California. For a more complete discussion of policy development, copies of the model policy recommendations are available from the Regional Perinatal Program of California office in the eleven regions across the state:

<http://www.cdph.ca.gov/programs/rppc/Pages/RPPCCountyListings.aspx>

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

<http://www.cdph.ca.gov/programs/BreastFeeding/Pages/default.aspx>

<b>Table 3. SUMMARY OF MODEL HOSPITAL POLICY RECOMMENDATIONS (8)</b>
<p><b>PURPOSE:</b> These policy recommendations are designed to give basic information and guidance to perinatal professionals who wish to revise policies that affect the breastfeeding mother. Rationale and references are included as education for those unfamiliar with current breastfeeding recommendations. When no reference is available, the interventions recommended are considered to be best practice as determined by consensus of the Inland Empire Breastfeeding Coalition.</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 teaching.</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>
<p>To access the whole document go to:  <a href="http://www.cdph.ca.gov/programs/breastfeeding/Documents/MO-05ModelHospitalPolicyRecommend.pdf">http://www.cdph.ca.gov/programs/breastfeeding/Documents/MO-05ModelHospitalPolicyRecommend.pdf</a></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) to serve as a framework for addressing the special needs of people with diabetes. We will address the special needs of women with diabetes who choose to breastfeed within these categories:

- ❖ 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 of the research 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. Specifically, breastfeeding reduces the risk of the infant becoming obese or developing impaired glucose tolerance or diabetes (10). Research suggests that this protection extends into adulthood. For women with diabetes, breastfeeding benefits include: reduced risk of obesity, cardiovascular disease, and metabolic disease such as DM (11, 12, 13). Many women also find their diabetes more easily managed after the birth of the baby when they breastfeed (14).

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

<b>Table 4. RISKS OF NOT BREASTFEEDING FOR INFANTS AND MOTHERS (15, 16)</b>	
<b>Infant</b>	<b>Mother</b>
<ul style="list-style-type: none"> <li>❖ Diarrhea and gastroenteritis</li> <li>❖ Necrotizing enterocolitis in preterm infants</li> <li>❖ Sudden Infant Death Syndrome (SIDS)</li> <li>❖ Asthma, pneumonia, ear infections, and bacterial infections</li> <li>❖ Childhood obesity and type 2 diabetes</li> <li>❖ Childhood leukemia</li> </ul>	<ul style="list-style-type: none"> <li>❖ Retention of gestational weight gain</li> <li>❖ Postpartum depression</li> <li>❖ Type 2 diabetes</li> <li>❖ Metabolic syndrome</li> <li>❖ Premenopausal breast cancer</li> <li>❖ Ovarian cancer</li> </ul>

Breastfeeding may also reduce the risk for conditions later in life (17). 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. Risk of type 2 diabetes is reduced among parous women with no history of gestational diabetes (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 (18, 19, 20, 21). Recent research appears to support the role of exclusive breastfeeding in at least delaying the onset of type 1 diabetes in susceptible children (22). Research is continuing with the Finnish Trial to Reduce IDDM in the Genetically at Risk Study (TRIGR).

Studies with type 1 diabetes and breastfeeding have been controversial. Most studies demonstrate a benefit for the offspring when compared to formula-feeding (20, 22, 23). There are some studies with contradictory findings in regard to the benefits of breastfeeding in relation to offspring obesity and neurological development (24, 25). Overall, breastfeeding appears to be a major 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 women with type 2 diabetes or GDM are less likely to breastfeed than women without diabetes. 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.

Breastfeeding improves the subsequent glucose tolerance. Two small studies assessed the influence of lactation on glucose tolerance in women without diabetes. Lactating women all had higher prolactin levels and significantly lower levels of estradiol ( $p < 0.0005$ ) as well as lower fasting glucose and insulin levels ( $p = 0.05$ ). The authors concluded that the low levels of estradiol associated with breastfeeding may confer a protective effect with respect to glucose tolerance (9). Another study by McManus et al. demonstrated improved  $\beta$  cell function with 3 months of breastfeeding in women with a history of GDM (26).

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 (14). 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 (14).

Longer duration of breastfeeding was associated with reduced incidence of type 2 diabetes in 2 large US cohorts of women. The authors 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. This association appeared to wane with time since last birth (12). However, this study did not find a protective effect for reducing risk of type 2 diabetes for those women who developed gestational diabetes during their pregnancy (12).

### **Breastfeeding Benefits for the Offspring**

Infants of women with mild to severe glucose intolerance are at risk for infant and childhood obesity (10, 27, 28). Breastfed infants tend to be leaner than formula fed infants (28, 29, 30, 31, 32).

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. Studies suggest that breastfeeding can reduce the incidence of type 2 diabetes, particularly among Hispanics and non-Hispanic whites. A relationship has also been shown between breastfeeding and reduction of type 2 diabetes in Pima Indian children (33, 34). Although WHO and AHRQ identified studies that found breastfed infants were less likely to develop type 2 diabetes, some studies showed no association. At this time they conclude that it is not possible to draw conclusions on the long-term effects of breastfeeding on the risk of DM2 (35).

Research has shown a protective effect of exclusive breastfeeding against some cardiovascular risk factors in adult life (36).

### **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 (37). Another study found that delayed bottle-weaning corresponded to an increased risk of overweight in children aged 3-5 years (38).

Formula feeding has also been identified as a factor that increases the risk of overweight (39). Bottle and formula use are modifiable factors that may prevent excess weight gain and thus disease risk for the child.

Exclusive breastfeeding is recommended for the first six months of life; however, if bottle-feeding does occur, there are specific recommendations for doing so, which can be found at:

<http://www.kellymom.com/bf/pumping/alternative-feeding.html>

### **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 (40). 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.

Early (preferably in the first half hour of life) and often (10 -12 times per 24 hours) breastfeeding can reduce this risk. 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 lactogenesis (41) as well as increase the likelihood the baby will be supplemented with formula (42, 43).

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

**Table 5. IMMEDIATE INTERVENTIONS TO AVOID HYPOGLYCEMIA IN THE NEWBORN**

- ❖ 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 after first feeding then check before subsequent feedings.
- ❖ Monitor infant blood glucose for at least 24 hours or until stable for at least three consecutive feedings.
- ❖ Avoid scheduling breastfeeding - encourage frequent feeding until the blood glucose is stable.
- ❖ Observe newborn for symptoms hypoglycemia (jitteriness, irritable cry, etc.) and check blood glucose.
- ❖ Abnormal glucose values need to be followed by rechecking blood glucose levels after interventions - refer to the [Impact of Maternal Diabetes on Fetal Development and Neonatal Chapter \(Ch 5\)](#) 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 should be fed to the newborn, if possible, by methods other than bottle and artificial nipple (such as a spoon, cup, eyedropper or feeding syringe) to prevent 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 (44, 45, 46). 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-1-3-reasons.html>

Promote early feeding at the breast by one hour of age. Encourage frequent feeding until infant blood glucose is stable ( $\geq 45$  mg/dl before feeding) (47). 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 (48, 49). 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 (24). Therefore, CDAPP Guidelines recommend tight control of blood glucose during lactation for optimal results.

Women with type 1 diabetes are encouraged to monitor fasting, pre-meal, 1-2 hours 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, 1-2 hours 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 (48, 49). 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 (50). 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.

Periods of maternal hyperglycemia have been associated with delayed lactogenesis as well (42), thus tight glucose control is recommended early in lactogenesis and throughout the breastfeeding experience.

### **Type 2 Diabetes/GDM**

Women with previous GDM may be advised to periodically check fasting and 1-2 hours post meal blood glucose values to be sure their blood glucose levels have returned to normal prior to the diagnostic OGTT at around 6 weeks postpartum. There are no data to support or refute this recommendation.

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.

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## **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 (refer to references for websites). 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 (40). 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 (51). 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 (52). 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. Metformin is excreted into breast milk, but the amounts seem to be clinically insignificant. No adverse effects on the blood glucose of the nursing infants were measured (53, 54). According to a small study published in 2005, neither glyburide or glipizide were detected in the breast milk, and hypoglycemia was not observed in three nursing infants. The authors concluded “both agents appear to be compatible with breastfeeding” (53). There are no reports of infant side effects (52).

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\*  
CATEGORY (55)**

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 lowering blood pressure or blood pressure lowering pills. Refer to table 8 below:

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.

Concern is raised regarding the safety of medication because limited safety data is available (56). No professional medical association has issued formal guidelines regarding pregnant or lactating women and use of psychiatric medication treatment including SSRIs. 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 (57, 58). 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 (59).

<b>Table 9. SOME PSYCHIATRIC MEDICATIONS' LACTATION RISK* CATEGORY (55)</b>	
<b>Medication</b>	<b>Lactation Risk Category</b>
<b>Antidepressants</b>	
Sertraline, Fluoxetine, Citalopram	L2
<b>Mood Stabilizers</b>	
Carbamazepine, Valproic Acid	L2
Lithium	L3
<b>Anxiolytics</b>	
Valium, Clonazepam, Lorazepam	L3
<b>Antipsychotics</b>	
Quetiapine (Sorequel)	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 <a href="#">Appendix A</a> 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 (60, 61). To this point, data is reassuring. 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 (62).

SSRIs are preferred by many when treating depression, but more safety data on breastfeeding is ultimately needed (62).

Sertraline has shown low umbilical cord to maternal serum ratios in small samples and has reassuring breastfeeding data (63).

- ❖ 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 (64).
- ❖ Citalopram, (and escitalopram) unlike sertraline, has been studied more frequently but has a higher fetal-maternal serum level. These are viewed as the next choice after sertraline or fluoxetine (65).

### **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 (66, 67, 68). AAP determined carbamazepine and valproic acid are appropriate for breastfeeding women (69). 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 (69).

### **Anxiolytics**

Data on benzodiazepines, diazepam (Valium), clonazepam (Klonopin), lorazepam (Ativan) is limited (70) 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) (71). Data on clozapine suggests it is concentrated in breast milk but there is no data on infant serum levels. Significant adverse effects of clozapine in adults include decreased white blood count (72).

### **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.

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### **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 recurrence. 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 (73, 74) because they are associated with increased diabetes rates.

Further information on contraception for women with diabetes can be found in [Medical Management and Education of Gestational Diabetes Mellitus \(Ch 4\)](#).

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## Appendix A

## Dr. Hales Lactation Risk Category

Dr. Hales Lactation Risk Category (55)	
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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▶ *CDAPP Sweet Success*  
*Guidelines*  
*for Care*

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Chapter 9  
Behavioral and  
Psychosocial  
Components of  
Care

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*Sweet Success*  
California Diabetes and Pregnancy Program

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# 9 Behavioral and Psychosocial Components of Care

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# 9 Behavioral and Psychosocial Components of Care

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## 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 protective time, research has 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 and cognitive development and the woman's ability to care for herself (2, 3).

---

## 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 thorough 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 is in contrast to the traditional compliance oriented approach to patient care (4). This paradigm shift to a philosophy of patient empowerment recognizes the woman as a co-provider of her care. 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, and
- ❖ how the woman's degree of emotional well-being 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, 6). 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 risk, and place increased adjustment and adaptation demands on a woman, her inner resources and external support system. 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 (7). These services "start where the woman is" and are directed toward engaging her 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 sugar 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 don't 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,
- ❖ support to have her voice respected when communicating with the health care team, and
- ❖ 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 (8). 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 explore and resolve any ambivalence to treatment (9). 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 (10). MI is especially effective with the management of diseases such as diabetes, that require 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.

---

### STAGES OF CHANGE MODEL

The "Stages of Change" model shows that change occurs gradually and often advances in a non-linear spiral progression (11). 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 don't get stopped at the barrier caused by belief that the patient is "non-compliant", but instead, begin asking questions that expand rather than constrict their understanding.

There are six stages in this model (refer to [Appendix A](#)).

For simplicity, we are briefly listing these stages with examples of patient behavior and provider questions:

### **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: 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**

- ❖ 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.



---

## 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 don't 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 is strongly encouraged for all women, regardless of social status, educational level, race, or ethnicity. This integrative model is recommended by American Diabetes Association and American College of Obstetricians and Gynecologists (12, 13, 14).

Beyond initial screening, additional monitoring is recommended when:

- ❖ a mother's participation in care diminishes
- ❖ she has increased life stressors; or
- ❖ she exhibits distressed interactions with providers.

You may find [Appendix B](#), the Stress Check in English and [Appendix C](#), the Stress Check in Spanish useful to assess the client's level of stress. 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. [Appendix D](#) provides information for screening for domestic violence.

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", perinatal depression is evident in up to 28% of women and is one of the most common perinatal complications (16).

Many factors influence maternal mental health including:

- ❖ family history of depression
- ❖ hormonal changes
- ❖ poor environmental factors
- ❖ intimate partner violence
- ❖ chronic stressors and trauma
- ❖ oppression and racism and
- ❖ isolation from adequate social and community support (17)

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

Key points for providers to keep in mind:

- ❖ Approximately 14-25% of pregnant women meet the criteria for clinical diagnosis of depression as outlined in the DSM IV (18).
- ❖ The rates of depression in the second and third trimester 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:

- ❖ Interrupt attachment behaviors, such as an infant's attunement to emotional signals of their mother's voice, gestures, and facial expressions (19)
- ❖ 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 mothers
- ❖ 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 (20). As the EPDS is a screening tool, 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. With training in use of the screening tool, scoring it and developing an action plan based on the findings, all health care team members can screen diabetic women.

Ideally, providers should screen patients once during the following time periods:

- ♦ the second trimester
- ♦ the third trimester
- ♦ six weeks postpartum and
- ♦ at three months after delivery to identify most women who experience perinatal depression

### **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.

**NOTE:** Please see [Appendix E](#) for scoring and use information for EPDS, [Appendix F](#) for the EPDS in English, and [Appendix G](#) for the EPDS in Spanish. Question # 10 identifies high suicide risk and any answer scoring above zero might require immediate mental health intervention or contact with emergency care for further evaluation.

### **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 (21) and interpersonal psychotherapy
- ❖ Exercise which is important to maintain blood sugars 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 (22). 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, a baby with birth defects, still births or neonatal death (7). 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 (4). She may also experience 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. Refer to the Medical Management section of the Guidelines

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### 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)  
National Perinatal Hotline 1.800.773.6667  
Postpartum Support International 1.800.944.4773
  
- ❖ Online resources  
[www.mededppd.org/mothers](http://www.mededppd.org/mothers)  
<http://www.motherisk.org/women/index.jsp>  
[www.beyondblue.org.au](http://www.beyondblue.org.au)  
<http://ctispregnancy.org/>

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## Appendix A

**Understanding the Stages of Change**

From Changing for Good by James Prochaska (used with permission from J Prochaska)

<b>Stage</b>	<b>Attitude</b> <b>Time Frame</b>	<b>Behavior</b>	<b>Condition</b>
Stage # 1 <b>Pre-contemplation</b>	Unaware of problems associated with behavior. Certain that the positives of the behavior outweigh the negative. Not interested in Change. Unwilling to change. No intention to change.		Unaware Resistant
Stage # 2 <b>Contemplation</b>	Becomes aware of problems associated with behavior. Ambivalent regarding positives and negatives. Explores the potential to change. Desires to change behavior but lacks confidence and commitment. Intends to change before 6 months.		Awareness Openness
<b>Decision</b>	This is an event, not a stage. Concludes that the negatives of the behavior out-weigh the positives and chooses to change behavior.		Commitment
Stage # 3 <b>Preparation</b>	Accepts responsibility to change behavior. Evaluates and selects techniques for the behavior. Develops a plan. Builds confidence and commitment. Intends to change within one month.		
Stage # 4 <b>Action</b>	Engages in self-directed behavior effort. Gains new insights and develops new skills. Consciously chooses new behavior. Learns to overcome the tendencies for unwanted behavior. Active in action stage for less than six months.		
Stage # 5 <b>Maintenance</b>	Masters the ability to sustain new behavior patterns and self-control. Remains alert to high-risk situations. Focus in on lapse prevention. Has changed behavior for six months.		
<b>Lapse or Relapse</b>	This is an event, not a stage. May occur at any time. Personal distress or social pressures are allowed to interrupt the behavior or change process. Temporary loss of progress which resumes at an earlier stage. Experience is educational to help prevent further recurrence.		
Stage # 6 <b>Termination</b>	Adopts new self-image consistent with desired behavior and lifestyle. Does not react to temptation in any situation. Expresses confidence and enjoys self-control. Appreciates healthier and happier life.		

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**Appendix B****Sweet Success Stress Check California Diabetes and Pregnancy Program**

Welcome to Sweet Success! It is our goal to assist you during your pregnancy to manage your diabetes. Living with diabetes can be difficult. Your feelings and reactions to stressful situations and other worries can affect your blood sugar or what foods you choose to eat.

We want to help you take good care of yourself and your pregnancy. Although diabetes includes testing your blood sugar levels and eating recommended foods, it also includes learning how stress and problems in your life affect YOU and how you cope with them.

Please complete the following questions. Your answers will help us have a better understanding of how we can be of more assistance. We keep your answers confidential and private. Feel free to talk about your concerns with any of our staff.

Thank you.

Name: \_\_\_\_\_ Today's Date: \_\_\_\_\_ Baby's Due Date: \_\_\_\_\_

What kind of diabetes do you have?      Type 1      Type 2      Gestational (GDM)      I am not sure

For the following statements, please circle the number that best describes how you agree or disagree.

	<b>Strongly Disagree 1</b>	<b>Disagree 2</b>	<b>Neutral 3</b>	<b>Agree 4</b>	<b>Strongly Agree 5</b>
<b>Coping With Diabetes</b>					
I find it hard to believe I have diabetes.	1	2	3	4	5
I find it hard to understand all the information.	1	2	3	4	5
I can easily test my blood sugar levels 4 times a day	1	2	3	4	5
I need help handling my feelings about diabetes.	1	2	3	4	5
I am comfortable with my diabetes care team.	1	2	3	4	5
<b>Caring For You and Your Needs</b>					
I have family and friends who support me if I need it.	1	2	3	4	5
I feel safe and supported in my life right now.	1	2	3	4	5
I am in a safe, stable relationship now.	1	2	3	4	5
In general, I feel happy about this pregnancy.	1	2	3	4	5
I had losses in past pregnancies that worry me now.	1	2	3	4	5
There are things in my life that are overwhelming	1	2	3	4	5
I have many problems in my life right now.	1	2	3	4	5
<b>Coping</b>					
I handle my feelings fairly well.	1	2	3	4	5
I know diabetes causes stress in my life.	1	2	3	4	5
I see how stress changes my blood sugar numbers.	1	2	3	4	5
I could use help handling my negative feelings.	1	2	3	4	5
I may want to talk with someone about the stress I have	1	2	3	4	5
<b>Food and Eating</b>					
I am confident I can manage my diet at home.	1	2	3	4	5
I am confident I can manage my diet away from home.	1	2	3	4	5
I get support from my family for my diabetic diet.	1	2	3	4	5
I can eat the right foods even when I cook for others.	1	2	3	4	5

**Appendix B, Continued**

1. What makes it difficult for you to take care of yourself?

Finding it hard to believe I have diabetes  
 Family or friends not understanding or not being supportive  
 What other people say about how I should take care of my diabetes  
 Family stress (problems with children or partner/spouse)  
 Job stress or lack of work  
 Money problems or worries  
 Having trouble resting or relaxing  
 Drinking beer, wine or other alcohol  
 Smoking marijuana or using other drugs  
 Smoking tobacco, cigarettes  
 Other, please explain

**TAKING CARE OF YOU**

2. What is positive in your life right now and/or what do you feel good about?

My marriage/relationship	Family support
Support from friends	Faith/religion
My ability to be flexible	I can make good decisions
Other, please explain	

3. What do you do when you feel upset or stressed?

Keep it to myself	Get angry or yell
Keep busy & not think about it	Eat
Cry	Exercise
Talk with a family member	Drink alcohol or use drugs
Other, please explain	

4. What person, advice, care or support is helpful to you?

Friends or family	Mother or mother-in-law
Spiritual leader (priest, minister, elder, shaman, Iman)	Herbalist
Other	Curandera/Healer

5. I would like to discuss my family history of diabetes and how it impacts the future of my family      Yes      No

6. I would like information about reducing stress      Yes      No

7. I would like a referral for food, housing or clothing      Yes      No

Thank you for taking the time to complete this questionnaire. Your answers will assist us in working with you.

**Appendix C****Sweet Success Stress Check - Spanish California Diabetes and Pregnancy Program**

¡Bienvenidos a Sweet Success! Nuestra meta es ayudarle a manejar su diabetes durante su embarazo. Es difícil vivir con diabetes. Sus sentimientos y reacciones a situaciones estresantes y otras preocupaciones pueden afectar el azúcar en su sangre o los tipos de alimentos que usted escoge para comer.

Queremos ayudarle a cuidarse a sí misma y a su embarazo. Cuidar de su diabetes incluye pruebas de sus niveles de azúcar en la sangre y el comer alimentos recomendados. También incluye aprender como el estrés y los problemas en su vida la afectan a USTED y como usted puede sobrellevarlos.

Por favor complete las siguientes preguntas. Sus respuestas nos ayudarán a tener un mejor entendimiento acerca de cómo podemos ayudarle. Mantenemos sus respuestas confidenciales y privadas. Siéntase libre de hablar acerca de sus preocupaciones con cualquiera de nuestro personal.

Gracias.

Nombre: \_\_\_\_\_ Fecha de Hoy: \_\_\_\_\_ Fecha Prevista del Bebé: \_\_\_\_\_

¿Que tipo de diabetes tiene usted?      Tipo 1      Tipo 2      De Gestación (GDM)      No estoy segura

Para las siguientes declaraciones, por favor circule el número que mejor describe su acuerdo o desacuerdo:

	<b>Muy en Desacuerdo</b>	<b>Desacuerdo</b>	<b>Neutral</b>	<b>Acuerdo</b>	<b>Muy en Acuerdo</b>
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>Enfrentándose a la Diabetes</b>					
Encuentro difícil creer que tengo diabetes	1	2	3	4	5
Encuentro difícil comprender toda la información	1	2	3	4	5
Fácilmente me pruebo mis niveles de azúcar 4 veces al día	1	2	3	4	5
Necesito ayuda para controlar mis sentimientos acerca de la diabetes.	1	2	3	4	5
Me siento confortable con mi equipo de cuidado para mi diabetes.	1	2	3	4	5
<b>Cuidados Para Usted y Sus Necesidades</b>	1	2	3	4	5
Tengo amigos y parientes que me apoyan si lo necesito.	1	2	3	4	5
En este momento me siento segura y apoyada en mi vida.	1	2	3	4	5
De momento me encuentro en una relación segura y estable.	1	2	3	4	5
En general, me siento feliz acerca de este embarazo.	1	2	3	4	5
Tuve pérdidas en embarazos previos y eso me preocupa hoy.	1	2	3	4	5
Hay cosas en mi vida que me abruman.	1	2	3	4	5
Tengo muchos problemas en mi vida ahora.	1	2	3	4	5
<b>Enfrentándose</b>					
Controlo mis sentimientos bastante bien.	1	2	3	4	5
Se que la diabetes causa estrés en mi vida.	1	2	3	4	5
Comprendo como el estrés cambia los niveles de azúcar en mi sangre.	1	2	3	4	5
Necesito ayuda para controlar mis sentimientos negativos.	1	2	3	4	5
Tal vez desee hablar con alguien acerca del estrés que me afecta.	1	2	3	4	5
<b>Los Alimentos y la Alimentación</b>					
Confío que puedo controlar mi dieta en casa.	1	2	3	4	5
Confío que puedo controlar mi dieta fuera de casa.	1	2	3	4	5
Recibo apoyo de mi familia para mi dieta diabética.	1	2	3	4	5
Puedo comer los alimentos correctos aun cuando cocino para otros.	1	2	3	4	5

**Appendix C, Continued**

1. ¿Qué le dificulta cuidarse usted misma?
- Encontrar difícil creer que yo tengo diabetes
  - Falta de comprensión por mi familia o amistades
  - Lo que otra gente dice acerca de cómo debo cuidar mi diabetes
  - Problemas de familia (problemas con los hijos o su pareja)
  - Estrés en el trabajo o falta de empleo
  - Problemas de dinero o preocupaciones
  - Problemas para descansar o relajarme
  - Tomar cerveza, vino o licores
  - Fumar marihuana o el uso de otras drogas
  - Fumar tabaco, cigarrillos
  - Otros, por favor expliquen

**CUIDÁNDOSE A SI MISMA**

2. ¿Qué cosa es positivo en su vida ahora y / o qué le hace sentirse bien?
- |                                      |                               |
|--------------------------------------|-------------------------------|
| Mi matrimonio / relación sentimental | Apoyo familiar                |
| El apoyo de mis amigos               | Mi Fe / religión              |
| Mi habilidad de ser flexible         | Puedo tomar buenas decisiones |
| Otras, por favor explique            |                               |
3. ¿Qué hace usted cuando se siente disgustada o estresada?
- |                                      |                             |
|--------------------------------------|-----------------------------|
| Mantenerlo consigo mismo             | Enojarme o gritar           |
| Mantenerme ocupado y no pensar en el | Comer                       |
| Llorar                               | Hacer ejercicio             |
| Platicar con algún pariente          | Tomar alcohol o usar drogas |
| Otro, por favor explique             |                             |
4. ¿Qué persona, consejo cuidado o apoyo es de ayuda para usted?
- |  |               |
|--|---------------|
| Amigos o familia   | Mamá o suegra |
| Dirigente espiritual (sacerdote,<br>ministro, anciana, chamán, Imán) | Herborista    |
| Otro   | Curandera     |
5. Deseo discutir mi historial familiar acerca de la diabetes y como impactará el futuro de mi familia      Si      No
6. Yo deseo información sobre cómo reducir el estrés      Si      No
7. Deseo información sobre cómo obtener alimentos, vivienda o ropa      Si      No

Gracias por tomar el tiempo para completar esta encuesta. Sus respuestas nos ayudarán a trabajar con usted.



---

**Appendix D****A Domestic Violence Tool for Healthcare Providers**

Domestic/Intimate Partner Violence (DV/IPV) in the United States is reported by 20-25% of women as a problem at some point in their lifetime. Universal screening is necessary for all clients because no one group is without risk. Domestic violence may be physical, sexual or emotional. It may increase during pregnancy and it is especially important for health care providers to assess for risk factors. Health care providers are in a unique position to help save lives by assessing for DV, providing referrals, assisting in creating a safety plan, and educating about resources. Asking your patients about domestic violence will get easier for you the more you do it. For the patient who is pregnant and has a diagnosis of diabetes, resources and access to care are available.

Health care providers should look for:

- ❖ Injuries to head and neck
- ❖ Multiple or repeated injuries or bruising at different stages of healing
- ❖ Vague complaints about headaches or stomach pains
- ❖ Injuries to breast, abdomen, or genitals
- ❖ Miscarriage or any injury during pregnancy

Some behavioral signs and symptoms you should look for include:

- ❖ Missed appointments
- ❖ Seeking care from different providers
- ❖ Reasons given for an injury are inconsistent with the nature of the injury
- ❖ Intimate partner refuses to allow the patient to be seen alone during the examination

Let “SAFE” be your guide. Ask your patients the following questions:

❖ **Safe**

What stress do you feel in your intimate relationship?  
Are you be concerned about yourself and your children's safety?

❖ **Afraid**

Are there times in your relationship when you are afraid?  
What happens when you and your partner disagree?  
Has your partner ever threatened or hurt you or your children?

---

**Appendix D, Continued****❖ Friends/Family**

Have your friends or family ever told you they are worried about you or your children's safety?

Do any of your family or friends know that you've been hurt?

Would you be able to tell them?

What would they think about it?

Would they help you?

**❖ Emergency**

Are you in danger now?

In an emergency, do you and your children have a safe place to go? (A safety plan can be created. Help your patient write names and phone numbers on an emergency preparedness card. Refer to [Planning for Your Diabetes Care in a Domestic Violence Shelter](#) on the CDAPP Sweet Success web site for more information)

When physical abuse has occurred, immediately escort the patient to the Emergency Department. A physical assessment of pregnancy status should include:

- ❖ Fetal Heart Rate (FHR)
- ❖ Non-Stress Test (NST)
- ❖ Amniotic Fluid Index (AFI)
- ❖ Biophysical File (BPF)
- ❖ Obstetrical ultrasound
- ❖ Uterine contractions
- ❖ Vaginal bleeding
- ❖ Leakage of amniotic fluid
- ❖ And other signs of progressing labor/imminent delivery

If you need more information:

- ❖ [www.safehorizon.org](http://www.safehorizon.org)
- ❖ [www.nlm.nih.gov/medlineplus/domesticviolence.html](http://www.nlm.nih.gov/medlineplus/domesticviolence.html)
- ❖ Domestic Violence Helpline - 800-978-3600

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**Appendix E****About the Edinburgh Postnatal Depression Scale, Scoring and Instructions for Its Use****About the EPDS**

Response categories are scored 0, 1, 2 and 3 according to increased severity of the symptom. Items 3, 5 - 10 are reverse scored (i.e., 3, 2, 1, and 0). The total score is calculated by adding together the scores for each of the ten items. Users may reproduce the scale without further permission providing they respect copyright (which remains with the British Journal of Psychiatry) by quoting the names of the authors, the title and the source of the paper in all reproduced copies.

The Edinburgh Postnatal Depression Scale (EPDS) was developed to assist primary care health professionals in detecting mothers suffering from postpartum perinatal depression (PPD); a distressing disorder more prolonged than the "blues" (which occur in the first week after delivery), but less severe than puerperal psychosis. Please note that the EPDS is effective during the entire perinatal period.

Multiple studies have shown that PPD affects at least 10 percent of women and that many depressed mothers remain untreated. The rates of depression for women of poverty can be as high as 28%. These mothers may cope with their baby and with household tasks, but their enjoyment of life is seriously affected and it is possible that there are long term effects on the infant's overall development and family healthy functioning.

The EPDS was developed at health centers in Livingston and Edinburgh. It consists of 10 short statements. The mother underlines which of the four possible responses is closest to how she has been feeling during the past week. Most mothers complete the scale without difficulty in less than five minutes.

The validation study showed that mothers who scored above a threshold 9-12/13 were likely to be suffering from a depressive illness of varying severity. Nevertheless, the EPDS score should not override clinical judgment. A careful clinical assessment should be carried out to confirm the diagnosis. The scale indicates how the mother felt during the previous week, and in doubtful cases it may be usefully repeated after two weeks. The scale will not detect mothers with anxiety neuroses, phobias or personality disorders.

---

**Appendix E, Continued****Instructions for Users**

1. The mother is asked to underline the response that comes closest to how she has felt during the previous seven days.
2. All 10 items must be completed.
3. Care should be taken to avoid the possibility of the mother discussing her answers with others.
4. The mother should complete the scale herself, unless she has limited English or has difficulty with reading.
5. The EPDS may be used during pregnancy and/or at six to eight weeks postpartum to screen postnatal women. The child health clinic, postpartum check-up or a home visit may provide suitable opportunities for its completion.

Cox JL, Holden JM., Sagovsky R. Detection of postnatal depression: Development of the 10-item Edinburgh Postnatal Depression Scale. *British Journal of Psychiatry.* 1987;150:782-786.

**Appendix F**

**Edinburgh Postnatal Depression Scale (EPDS) - English**

Date: \_\_\_\_\_ Clinic Name/Number: \_\_\_\_\_

Your Age: \_\_\_\_\_ Weeks of Pregnancy/Age of Baby: \_\_\_\_\_

Since you are either pregnant or have recently had a baby, we want to know how you feel. Please place a **CHECK MARK (✓)** on the blank by the answer that comes closest to how you felt **IN THE PAST 7 DAYS** - not just how you feel today. Complete all 10 items and find your score by adding each number that appears in parentheses (#) by your checked answer. This is a screening test; not a medical diagnosis. If something doesn't seem right, call your health care provider regardless of your score.

Below is an example already completed.

I have felt happy:  
 Yes, all of the time \_\_\_\_\_ (0)  
 Yes, most of the time  (1)  
 No, not very often \_\_\_\_\_ (2)  
 No, not at all \_\_\_\_\_ (3)

This would mean: "I have felt happy most of the time" in the past week. Please complete the other questions in the same way.

1. I have been able to laugh and see the funny side of things:  
 As much as I always could \_\_\_\_\_ (0)  
 Not quite so much now \_\_\_\_\_ (1)  
 Definitely not so much now \_\_\_\_\_ (2)  
 Not at all \_\_\_\_\_ (3)
2. I have looked forward with enjoyment to things:  
 As much as I always did \_\_\_\_\_ (0)  
 Rather less than I used to \_\_\_\_\_ (1)  
 Definitely less than I used to \_\_\_\_\_ (2)  
 Hardly at all \_\_\_\_\_ (3)
3. I have blamed myself unnecessarily when things went wrong:  
 Yes, most of the time \_\_\_\_\_ (3)  
 Yes, some of the time \_\_\_\_\_ (2)  
 Not very often \_\_\_\_\_ (1)  
 No, Never \_\_\_\_\_ (0)
4. I have been anxious or worried for no good reason:  
 No, not at all \_\_\_\_\_ (0)  
 Hardly ever \_\_\_\_\_ (1)  
 Yes, sometimes \_\_\_\_\_ (2)  
 Yes, very often \_\_\_\_\_ (3)
5. I have felt scared or panicky for no good reason:  
 Yes, quite a lot \_\_\_\_\_ (3)  
 Yes, sometimes \_\_\_\_\_ (2)  
 No, not much \_\_\_\_\_ (1)  
 No, not at all \_\_\_\_\_ (0)
6. Things have been getting to me:  
 Yes, most of the time i haven't been able to cope at all \_\_\_\_\_ (3)  
 Yes, sometimes I haven't been coping as well as usual \_\_\_\_\_ (2)  
 No, most of the time i have coped quite well \_\_\_\_\_ (1)  
 No, i have been coping ad well as ever \_\_\_\_\_ (0)

7. I have been so unhappy that I have had difficulty sleeping  
 Yes, most of the time \_\_\_\_\_ (3)  
 Yes, sometimes \_\_\_\_\_ (2)  
 No, not very often \_\_\_\_\_ (1)  
 No, not at all \_\_\_\_\_ (0)
8. I have felt sad or miserable:  
 Yes, most of the time \_\_\_\_\_ (3)  
 Yes, quite often \_\_\_\_\_ (2)  
 Not very often \_\_\_\_\_ (1)  
 No, not at all \_\_\_\_\_ (0)
9. I have been so unhappy that I have been crying:  
 Yes, most of the time \_\_\_\_\_ (3)  
 Yes, quite often \_\_\_\_\_ (2)  
 Only occasionally \_\_\_\_\_ (1)  
 No, never \_\_\_\_\_ (0)
10. The thought of harming myself has occurred to me: \*  
 Yes, quite often \_\_\_\_\_ (3)  
 Sometimes \_\_\_\_\_ (2)  
 Hardly ever \_\_\_\_\_ (1)  
 Never \_\_\_\_\_ (0)

**TOTAL YOUR SCORE HERE**

\* If you scored a 1, 2, or 3 on question 10. **PLEASE CALL YOU HEALTH CARE PROVIDER (OB/Gyn, family doctor or nurse midwife) OR GO TO THE EMERGENCY ROOM NOW** to ensure you own safety and that of your baby.

If your total score is 11 or more, you could be experiencing postpartum depression (PPD) or anxiety. **PLEASE CALL YOU HEALTH CARE PROVIDER (OB/Gyn, family doctor or nurse midwife) now** to keep you and your baby safe.

If your total score is 9-10, we suggest you repeat this test in one week or call your health care provider (OB/Gyn, family doctor or nurse midwife).

If your total score is 1 - 8, new mothers often have mood swings that make them cry or get angry easily. Your feelings may be normal. However, if they worsen or continue for more than a week or two, call your health care provider (OB/Gyn, family doctor or nurse-midwife). Being a mother can be new and stressful experience. Take care of your by:

- Getting sleep - nap when the baby naps.
- Asking friends and family for help.
- Drinking plenty of fluids.
- Eating a good diet.
- Getting exercise, even if it's just walking outside.

Regardless of your score, if you have concerns about depression or anxiety, please contact your health care provider.

Please note: The Edinburgh Postnatal Depression Scale (EPDS) is a screening tool that does not diagnose postpartum depression (PPD) or anxiety).

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Appendix G

Edinburgh Postnatal Depression Scale (EPDS) - Spanish

Fecha: \_\_\_\_\_ Nombre de la clínica/número: \_\_\_\_\_

Su edad: \_\_\_\_\_ Semanas de embarazo/edad del bebé \_\_\_\_\_

Como usted esta embarazada o hace poco tuvo un bebé, nos gustaría saber como se ha estado sintiendo. Por favor **marque con ✓** la respuesta que más describa como se ha sentido en los **últimos 7 días**. Conteste las 10 preguntas. Luego, sume todos los números que están enseguida de la ✓ que marcó para ver cuál es su puntaje. Este no es un diagnostico. Si considera que algo no esta bien, independientemente de su puntajem hable con su médico o enfermera.

A continuación se muestra un ejemplo completado:

Me siento feliz:  
 Tanto como siempre \_\_\_\_\_ (0)  
 No tanto ahora  (1)  
 Mucho menos \_\_\_\_\_ (2)  
 No, en absoluto. \_\_\_\_\_ (3)

Esto significa: "Me he sentido feliz la mayour parte del tiempo" durante la última semana. Porfavor complete las otras preguntas de la misma manera .

1. He podido reír y ver el lado bueno de las cosas:  
 Si, tanto como siempre \_\_\_\_\_ (0)  
 Si, la jayour parte del tiempo \_\_\_\_\_ (1)  
 No, no con frecuencia \_\_\_\_\_ (2)  
 No, no he podido. \_\_\_\_\_ (3)
2. He mirado el futuro con placer:  
 Tanto como siempre \_\_\_\_\_ (0)  
 Menos que antes \_\_\_\_\_ (1)  
 Definitivamente menos que antes \_\_\_\_\_ (2)  
 No nada \_\_\_\_\_ (3)
3. Me he culpado innecesariamente cuando las cosas salieron mal:  
 Sí, la mayoría de las veces \_\_\_\_\_ (3)  
 Sí, algunas veces \_\_\_\_\_ (2)  
 No muy frecuentemente \_\_\_\_\_ (1)  
 No, nunca \_\_\_\_\_ (0)
4. He estado ansiosa y preocupada sin motivo:  
 No, nada \_\_\_\_\_ (0)  
 Rara vez \_\_\_\_\_ (1)  
 Sí, a veces \_\_\_\_\_ (2)  
 Sí, muy frecuentemente \_\_\_\_\_ (3)
5. He sentido miedo o pánico sin motivo alguno:  
 Sí, muy frecuentemente \_\_\_\_\_ (3)  
 Sí, a veces \_\_\_\_\_ (2)  
 No, no mucho \_\_\_\_\_ (1)  
 No, nada \_\_\_\_\_ (0)
6. Las cosas me han estado agobiando:  
 Sí, casi siempre \_\_\_\_\_ (3)  
 Sí, a veces \_\_\_\_\_ (2)  
 No, casi nunca \_\_\_\_\_ (1)  
 No, nada \_\_\_\_\_ (0)

7. Me he sentido tan infeliz, que he tenido dificultad para dormir:  
 Sí, casi siempre \_\_\_\_\_ (3)  
 Sí, a veces \_\_\_\_\_ (2)  
 No muy frecuentemente \_\_\_\_\_ (1)  
 No, nada \_\_\_\_\_ (0)
8. Me he sentido triste y miserable:  
 Sí, casi siempre \_\_\_\_\_ (3)  
 Sí, muy frecuentemente \_\_\_\_\_ (2)  
 No muy frecuentemente \_\_\_\_\_ (1)  
 No, nada \_\_\_\_\_ (0)
9. He estado tan infeliz que he estado llorando:  
 Sí, casi siempre \_\_\_\_\_ (3)  
 Sí, muy frecuentemente \_\_\_\_\_ (2)  
 Ocasionalmente \_\_\_\_\_ (1)  
 No, nunca \_\_\_\_\_ (0)
10. He considerado hacerme daño a mi misma:  
 Sí, muy frecuentemente \_\_\_\_\_ (3)  
 A veces \_\_\_\_\_ (2)  
 Rara vez \_\_\_\_\_ (1)  
 Nunca \_\_\_\_\_ (0)

**PONGA SUS PUNTOS AQUI**

\* Si tiene 1, 2, o 3 en la pregunta numero 10, **POR FAVOR HABLE A SU MEDICO O ENFERMERA INMEDIATAMENTE O ACUDA A UNA SALA DE EMERGENCIAS** para asegurar que no está en peligro ni usted ni su bebé.

Si tiene 11 puntos o más, puede tener depresión posparto o ansiedad. **POR FAVOR HABLE CON SU MEDICO O ENFERMERA** para mantener su seguridad y la de su bebé.

Si tiene 9 o 10 puntos, se le sugiere que repita esta prueba en una semana o que le hable a su médico o enfermera.

Si tiene entre 1 y 8 puntos; mamás nuevas a menudo tienen cambios de humor o estado de ánimo. Sus sentimientos son normales. Pero, si empeoran o continúan más de una semana o dos, hable con su médico o enfermera. Ser una madre nueva puede ser estresante. Cuídese haciendo lo siguiente:  
 Duerma bastante – tome una siesta cuando el bebé duerma  
 Pídale ayuda a sus amistades y familiares  
 Beba bastantes líquidos  
 Siga una buena dieta  
 Haga ejercicio aunque sea solamente caminar

Sin importar su puntaje, si le concierne algo o tiene preguntas sobre la depresión o ansiedad póngase en contacto con su médico o enfermera.

NOTA: el EPDS no diagnostica depresión o ansiedad.

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# ▶ *CDAPP Sweet Success* *Guidelines* *for Care*

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## Chapter 10

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### Cultural Competency



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California Diabetes and Pregnancy Program

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# 10 Cultural Competency

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# 10 Cultural Competency

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## INTRODUCTION

**“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 two tools, the ASKED Approach and LEARN Approach to guide health care providers to provide culturally sensitive care.

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## CULTURE, PREGNANCY, AND DIABETES

People’s cultural background affects their health practices and their response to physiological changes and illness (1). 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 (2). In times of crisis, 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 (3).

Since attitudes and beliefs about health protection and healing are essential components of cultural practices, the health beliefs among CDAPP Sweet Success patients vary. The cultural background of diabetes patients is becoming increasingly diverse (4). Cultures are ever-changing and yesterday’s taboos might be acceptable tomorrow. Learning about the many different cultures is challenging and requires providers to ASK and to LEARN, as explained below (5, 6).

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 (7). Information regarding the following issues will give you a sense of her level of acculturation.

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 ASKED Approach

Health care team members can utilize the ASKED Approach to assist them to assess their own cultural values and health beliefs.

**ASKED** stands for:

Awareness  
Skill  
Knowledge  
Encounters  
Desire

Providers can use the ASKED model to assess their own cultural values and health beliefs, such as, "In caring for this patient from a cultural group that's different than mine, have I ASKED myself the right questions?" (5)

### **Awareness**

- ❖ Awareness is a process of “cultural humility” – a lifelong commitment of self-evaluation and critique regarding one’s level of cultural awareness.
- ❖ Awareness involves a continuous examination of one’s own prejudices and biases toward other cultures and an in-depth exploration of one’s own cultural background.
- ❖ Awareness guides the team member to become aware, sensitive, and appreciative of the diversity in values, beliefs, and ways of dealing with life’s challenges.

As a provider, ask yourself: “What is my comfort level when addressing patients from cultures that are different from my own? Do I have personal biases or even prejudices towards cultural groups different from my cultural background?”

### **Skill**

- ❖ Am I skillful in gathering information about the client’s perception of pregnancy and diabetes issues?
- ❖ Am I skillful at listening with interest in a nonjudgmental manner?
- ❖ Am I skillful in respecting my client’s values and beliefs when teaching her about her diabetes care such as insulin injections or how to follow her diabetes meal plan?

As a provider ask yourself: “Do I have the skill to conduct a culturally sensitive physical assessment?”

### **Knowledge**

Do I have some knowledge of my client’s world view about:

- ❖ Diabetes and pregnancy
- ❖ Treatment efficacy
- ❖ Ethnic psychopharmacology (therapeutic doses of some medications can vary among ethnicities)
- ❖ Interactions between herbs and traditional treatments with insulin or other medications

### **Encounters**

- ❖ Be aware of nonverbal communications such as eye contact, facial expressions, sensitivity to touch, body language, and distancing practices.

Despite good intentions, nonverbal communications can be misinterpreted and perceived as offensive and insulting.

## Desire

Ask yourself:

- ❖ What is my desire for the outcome of this interaction?
- ❖ Do I have compassion to be open to others, to accept and respect differences?
- ❖ Am I willing to learn from others?

---

## The LEARN Approach

Health care team members can utilize the **LEARN** approach to assist them to improve their cross-cultural communication.

**LEARN** stands for:

Listen  
Express Empathy  
Acknowledge  
Recommend  
Negotiate

The LEARN model is a useful technique that has been used in health care settings for over 20 years. This approach can assist team members to develop cultural sensitivity and competence, which are required skills for all team members (8). The following sections suggest how team members can LEARN about the patient's cultural values and beliefs about pregnancy and diabetes (6).

## Listen

**Listen** for the patient's thoughts and feelings.

- ❖ What are the patient's beliefs about diabetes and treatment methods (9)?
- ❖ 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. 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 (3). Do these cultural expectations conflict with the team's recommendations?

- ❖ 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.
- ◆ 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.

#### **Express Empathy**

CDAPP Sweet Success providers and staff may be the only ones with whom the patient feels safe to express any negative feelings while her family and friends are expecting her to be happy and strong. Show compassion for a wide range of feelings, from sadness to anger to fear to numbness.

- ❖ 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.
- ❖ Show empathy for her sources of stress, like having to submit to western demand of time that differs from her culture's way of handling time.
- ❖ Show an awareness of and respect for her feelings, which may be tumultuous and contradictory (2).
- ❖ Help the patient integrate traditional self-care practices with the CDAPP Sweet Success approach to care where possible.

- ❖ 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.
- ❖ Have a woman bring in traditional foods. Encourage the woman to describe these special foods, her reason for eating them, her feelings associated with eating them and details about the tradition from which they came.

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 successfully treat her diabetes. It has been said that people don't care how much you know, until they first know how much you care (10).

#### **How to express EMPATHY:**

- ◆ Stay with the feelings; don't reason or argue.
- ◆ Observe your own feelings in response to your client's disclosure.
- ◆ Note your intuitive responses to the painful feelings and consider their usefulness 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 (11).
- ❖ Acknowledge the wisdom of mind-body tradition she may embrace. 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. 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.
- ❖ 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 (12).

**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.

---

**POST PARTUM 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 county, medical practitioners generally assume that it takes six weeks for women to regain internal organ and tissue function after giving birth (13). 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 choice, especially if she still has close ties to her mother, sisters, or aunts (14).

Her level of acculturation affects breastfeeding choices as much as it affects other health-related choices. Again, the LEARN model 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 (15).

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**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 ASKED and LEARN approaches, 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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