



# *CDAPP Sweet Success Guidelines for Care*

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## Chapter 2

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### Preconception and Interconception Care for Preexisting Diabetes



*Sweet  
Success*

California Diabetes and Pregnancy Program

## **California Diabetes and Pregnancy Program Sweet Success Guidelines for Care**

**Leona Shields, PHN, MN, NP and  
Guey-Shiang Tsay, RN, MSN (Editors)  
California Department of Public Health; Maternal, Child and  
Adolescent Health Division.**

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Regional California Diabetes and Pregnancy Program (CDAPP) Staff  
Charlene Canger, LCSW, MFT  
Leona Dang-Kilduff, RN, MSN, CDE  
Cathy Fagen, MA, RD  
Kristi Gabel, RNC, MSN, CNS  
Maribeth Inturrisi, RN, MS, CNS, CDE  
Melissa Ortiz, MA, RD, CDE  
Suzanne Sparks, RN, BSN, CDE

**CDPH CFH MCAH would like to gratefully acknowledge the contribution and review from the people listed below:**

**Additional CDAPP members:**

D. Lisa Bollman, RNC, MSN  
Sharmila Chatterjee, MSc, MS, RD  
Jenny Ching, RN, BSN  
Sara Corder, LCSW  
Geetha DeSai, MS, RD, CDE  
Kay Goldstein, MFT  
George Knapp, RN, MS  
Katina Krajniak, RN  
Sylvia Lane, PhD, LCSW  
Elaine Lee, MPH, RD, CDE  
Tracy Lewis, MSW  
Nancy McKee, LCSW, MSW  
Emmy Mignano, RD, MS, CDE  
Jacqueline Masullo, MSW, LCSW  
Lily Nichols, RD  
Deidre Paulson, MS, RD  
Sibylle Reinsch, PhD, MFCC  
Sadie Sacks, RN, MSN  
Melissa Shin, RN, BSN, PHN  
Trudy Theiss, RD, MS, CDE  
Susan Yoshimura, RD, CDE

**CDPH CFH MCAH Division Staff, Sacramento, California:**

Flojaune Griffin, PhD, MPH  
Suzanne Haydu, RD, MPH  
Janet Hill, MS, RD, IBCLC  
Maria Jocson, MD, MPH, FAAP  
Connie Mitchell, MD, MPH  
Susan Wallace, RN, (MPH student, UC Davis)  
Sangi Rajbhandari, MPH  
Karen Ramstrom, DO, MSPH  
Leona Shields, PHN, MN, NP  
Guey-Shiang Tsay, RN, MSN  
Cheryl Terpak, MS, RDH

**Medical experts:**

Kathleen Berkowitz, MD  
Barry Block, MD  
Roger Chene DHS(c), MPH, RD  
Conrad Chao, MD  
Maurice Druzin, MD  
Elizabeth Harleman, MD  
Lois Jovanovic, MD  
John Kitzmiller, MD  
Siri Kjos, MD  
Sherrie McElvy, MD  
Thomas Moore, MD  
David Sacks, MD  
Kimberlee Sorem, MD

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# *2 Preconception and Interconception Care for Preexisting Diabetes*

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

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

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

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INTRODUCTION  
TO  
PRECONCEPTION  
CARE

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

### **CDC's 10 Healthy Habits for Preconception Health and Health Care<sup>1</sup>**

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

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

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

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

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

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

**Family Planning**

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

**Folic Acid Supplementation**

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

**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.<sup>3</sup>

<b>Table 1. GOALS OF PRECONCEPTION CARE</b>
<p>To counter the increased proportion of spontaneous abortions and congenital malformations found in infants of diabetic mothers. This is achieved by:</p> <ul style="list-style-type: none"> <li>❖ Utilizing an effective contraceptive method until appropriate glycemia is reached and stabilized.</li> <li>❖ Assisting women to achieve an A1c &lt;6.0% prior to conception.</li> <li>❖ Identify additional diabetes-associated co-morbidities. Counsel the patient on associated pregnancy risks and treat as indicated.</li> <li>❖ Establish a care plan that involves patient participation and a multidisciplinary team approach when possible.</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 anywhere from 4.8-16.8% of pregnancies with a proportionate increase in the rate of anomalies with increased glycosylated hemoglobin.<sup>4-8</sup> 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<sup>9-11</sup>, and face a greater risk of preeclampsia, pyelonephritis, polyhydramnios, preterm birth, cesarean delivery and birth trauma.<sup>4,12</sup> While preconception care is strongly recommended, only 25-30% of childbearing age women with diabetes seek this care.<sup>12</sup> CDAPP Sweet Success providers strive to improve these statistics.

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

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

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

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



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

<b>Table 3. ASSESSMENT, PHYSICAL EXAMINATION AND LABS FOR WOMEN WITH PREEXISTING DIABETES<sup>3,4,7,12,13</sup></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<sup>14</sup></p>	< 6%	History of diabetic ketoacidosis, or hypoglycemia and patient awareness of signs, symptoms for these	<ul style="list-style-type: none"> <li>• A1c &lt; 6.0% 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<sup>3,13:</sup></b>                      Fasting Lipid/ Triglyceride levels</p> <p>If fatty liver disease is suspected check AST/ALT, and obtain liver ultrasound.</p>	TG ≤ 150 mg/dL HDL ≥ 50 mg/dL LDL ≤ 100 mg/dL	Assess for history of abnormal lipids  Fatty liver is associated with high BMI, and difficult glucose control. Associated with type 2 diabetes	<ul style="list-style-type: none"> <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<sup>3,13:</sup></b></p> <ul style="list-style-type: none"> <li>• TSH / T4                              If normal no follow-up required.</li> <li>• T4 values should only be used to monitor patients with hyperthyroidism<sup>15</sup></li> <li>• Abnormal TSH: follow-up every 4-6 weeks during preconception, each trimester and postpartum.</li> <li>• Thyroid Peroxidase Antibodies TPOAbs. If negative no F/U needed.</li> </ul>	TSH < 2.5 mIU/mL in 1st trimester <sup>16</sup>  If Being Treated: T4 = High Normal Range <sup>15</sup>  Negative	If a woman has a history of hyper-or hypothyroid evaluate labs before and during pregnancy to adjust treatment	<ul style="list-style-type: none"> <li>• Abnormal thyroid function effects fertility and increases risk of loss.<sup>16</sup> 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%).<sup>13</sup></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,<sup>3,4,7,12,13</sup> 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<sup>3,12,13</sup>:</b> Test blood pressure (BP) at every office visit.	Systolic BP < 120  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.<sup>4</sup></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 for Coronary Heart Disease: exercise intolerance; pain or heaviness in chest, neck, jaw, left arm; shortness of breath; vascular disease in extremities.	<ul style="list-style-type: none"> <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 Foot Care<sup>17</sup></b>			
Assess patient knowledge and instruct as necessary.	No skin breaks. Performs regular foot exams and care if necessary.	Assess history of skin breaks, foot care and infections.	<ul style="list-style-type: none"> <li>Any skin breaks leave a woman open to infection and adversely affect glucose control.</li> <li>Foot deformities will affect exercise prescription.</li> </ul>
<b>Microvascular</b>			
<b>Nephropathy<sup>4,9,13</sup>:</b> Urine dip for microalbuminuria, 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/24hr is normal  Total Protein < 150 mg/24 hr  Creatinine clearance 0.7-0.9 mg/dL and GFR (Glomerular Filtration Rate) > 60 m/min/m <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 long-term outcomes. Moderate to severe renal dysfunction has been associated with long-term renal disease 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 nephrologist is recommended.</li> <li>Dietary intervention may be indicated.</li> </ul>
<b>Retinopathy<sup>3,4,10,11,13,17</sup>:</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,<sup>3,4,7,12,13</sup> Continued</b>			
<b>Categories/ Complications/ Recommended Test/ Frequency</b>	<b>Target</b>	<b>History/ Signs and symptoms</b>	<b>Rationale/ Risk</b>
<b>Neuropathy<sup>3</sup></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) <sup>4</sup>  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>Increases morbidity and adverse 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>Increases adverse perinatal outcomes and requires careful 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>Electrophysiological studies show no block in conduction</li> </ul>	<ul style="list-style-type: none"> <li>Pain in legs</li> <li>Burning pain, stabbing; hyperesthesia, 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<sup>18,19:</sup></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.<sup>17</sup></li> <li>Most effective when identified and treated before pregnancy.</li> </ul>
<b>Celiac Disease<sup>3,13:</sup></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) 7 Self-Care Behaviors™ were briefly outlined in *Chapter 1: Overview*.<sup>20</sup> These behaviors are explained in more detail in relation to preconception and interconception. They apply at all ages and stages of diabetes care and management.<sup>20,21</sup>

**Healthy Eating**

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

**Being Active**

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

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

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

<b>Table 4. EXERCISE PRECAUTIONS FOR WOMEN TAKING GLUCOSE LOWERING AGENTS<sup>3</sup></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<sup>22</sup>

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

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

### Monitoring of Blood Glucose

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

Table 5 describes recommended frequency of glucose testing.

<b>Table 5. FREQUENCY OF SELF MONITORING BLOOD GLUCOSE (SMBG)<sup>3,13,23,24</sup></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.<sup>8</sup>

While CDAPP Sweet Success 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<sup>13,23,25,26</sup></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.<sup>3,27,28</sup> The A1c test is an important measure during preconception since control of blood glucose

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

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

- ❖ **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.<sup>30,31</sup>

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.<sup>32</sup>

- ❖ **Use of an Insulin Pump**  
When using an insulin pump, pre and post snack checks are sometimes necessary. Additional blood glucose checks may be needed for activities such as driving, exercise, or during suspected hyperglycemia or hypoglycemia.<sup>22</sup>
- ❖ **Gastroparesis**  
Women with gastroparesis or delayed gastric emptying prior to pregnancy, will need to identify their individual postmeal glucose peak. Modified meal planning and medications may be indicated<sup>3</sup> (refer to *Chapter: 7 Medical Nutrition Therapy* for more information).

## **Taking Medications**

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

- ❖ **Hypertension**  
The target blood pressure goals are systolic blood pressure of < 120 and a diastolic blood pressure of < 80. These targets should be maintained prior to and throughout pregnancy.<sup>3</sup> 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.<sup>33</sup> 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.<sup>34</sup> There are no clear recommendations for or against the use of oral antihypertensive agents in pregnant women with mild to moderate chronic hypertension.<sup>35,36</sup> If the decision is made to prescribe a medication for the treatment of chronic hypertension in pregnancy, the following in Table 7 should be considered. The goal of medical therapy is to achieve blood pressures near normal (target BP < 130/80).<sup>3</sup>

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

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



Lipid lowering interventions are addressed in Table 8 below:

Primary Intervention	Secondary Intervention	Not Recommended
<ul style="list-style-type: none"> <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 and have marginal efficacy when used by itself. Should be used with dietary interventions or Niacin.</li> </ul>	<ul style="list-style-type: none"> <li>• Continue all lipid lowering medications until actively attempting pregnancy. Once pregnancy is attempted statins are contraindicated.</li> </ul>

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

❖ Preconception Medication Management of Diabetes

*Oral Glucose-Lowering Agents*

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

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

*Insulin*

Since the advent of rapid acting insulins (lispro, aspart, apidra), many providers and patients prefer the insulin analogs to regular insulin. These insulin analogs are now used to control the one hour postmeal blood glucose levels. Regular insulin is less effective in lowering the 1 hour peak glucose, and less convenient to administer.<sup>3,14,41</sup> 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.<sup>14,41</sup> At this time the rapid acting insulin analogs lispro and aspart, and NPH are the preferred insulins for pregnancy.

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

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.<sup>14,22</sup>

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

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

*Continuous Subcutaneous Insulin Infusion*

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

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

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

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

Recommendations	Rationale
<ul style="list-style-type: none"> <li>Switch from oral glucose lowering agents (OGLA) to insulin when needed to maintain glycemic targets for at least 3 months before attempting conception.</li> </ul>	<ul style="list-style-type: none"> <li>OGLA often do not provide adequate glycemic control during organogenesis.</li> </ul>
<ul style="list-style-type: none"> <li>OGLA should not be discontinued until insulin can be started.</li> </ul>	<ul style="list-style-type: none"> <li>Hyperglycemia is a recognized teratogen.</li> </ul>
<ul style="list-style-type: none"> <li>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.</li> </ul>	<ul style="list-style-type: none"> <li>Hyperglycemia is a recognized teratogen.</li> <li>Neither glyburide nor metformin has caused developmental toxicity in humans in limited studies.<sup>39</sup></li> </ul>
<ul style="list-style-type: none"> <li>If multiple daily injections (MDI) is inadequate, CSII should be considered in women with type 2 diabetes.</li> </ul>	

### Problem Solving

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

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

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

❖ Hypoglycemia

Table 10 describes clinical maneuvers to prevent and treat hypoglycemia.

<b>Table 10. PRINCIPALS FOR THE PREVENTION AND TREATMENT OF HYPOGLYCEMIA<sup>42-44</sup></b>
<ul style="list-style-type: none"> <li>• Balance activity and food with insulin.</li> </ul>
<ul style="list-style-type: none"> <li>• With the initiation of OGLA or insulin, educate regarding signs and symptoms of hypoglycemia.</li> </ul>
<ul style="list-style-type: none"> <li>• With the use of OGLA or insulin instruct to always carry quick acting carbohydrate snacks and glucose tabs.</li> </ul>
<ul style="list-style-type: none"> <li>• 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.</li> </ul>
<ul style="list-style-type: none"> <li>• Glucose targets may be raised for women with hypoglycemia unawareness.</li> </ul>
<ul style="list-style-type: none"> <li>• If hypoglycemia occurs follow these directions<sup>42</sup>:                             <ul style="list-style-type: none"> <li>○ Treat with 25 grams of carbohydrate</li> <li>○ Re-check blood glucose in 15 minutes</li> <li>○ If blood glucose levels are still below 70 mg/dL, eat a secondary carbohydrate-rich snack</li> </ul> </li> </ul>
<p>If blood glucose &gt; 50 &lt; 70 + symptoms:</p> <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>
<p>If blood glucose &lt; 50 + Symptoms:</p> <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>
<p>If found unconscious:</p> <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 on how to adjust medications or activity to achieve glycemic control during their menstrual cycle.

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

### Reducing Risks

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

### Healthy Coping

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

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## SUMMARY

Table 11 addresses the optimal conditions for conception.

<b>Table 11. OPTIMAL CONDITIONS FOR CONCEPTION<sup>3,4,12,20</sup></b>
1. A1c equal to or below 6%
2. Stable Normoglycemia (80% blood glucose in Target)
3. Demonstrate the AADE 7 Self-Care Behaviors™ <sup>20</sup>
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 postpartum 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 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>❖ Very high effectiveness 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.</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>❖ Low 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:***

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

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

or

California Diabetes and Pregnancy Program (CDAPP) Sweet Success  
Resource and Training Center  
Tracy Esquivel, BA  
(714) 921-9755

<http://www.CDAPPSweetSuccess.org>

