



# Type 1 Diabetes Management Before, During, and After Pregnancy

## INTRODUCTION

Women with type 1 diabetes (T1D) have unique pregnancy-related needs.<sup>1</sup> Specifically, pregnancy planning and appropriate T1D management during pregnancy are critical to<sup>1</sup>:

- Maintain lower hemoglobin A1c (HbA1c) and optimal blood glucose (BG) levels throughout pregnancy
- Reduce the risk of congenital malformations
- Achieve greater gestational age at delivery
- Minimize the need for cesarean delivery
- Lower the risk of perinatal mortality

In addition, after delivery, women with T1D require careful readjustment of insulin doses, and contraception counseling is critical to prevent unplanned pregnancies.<sup>2</sup>

Consider the case of Justine, and think about how her current state of diabetes management could affect her health and the development and future health of her child:

- Justine is a 25-year-old G1P0 woman who has had T1D for 14 years; one month ago, her HbA1c was 12.7%
- She presents for this endocrine visit at 11 weeks' gestation; she has high-risk proliferative diabetic retinopathy in both eyes, which was previously treated with scattered laser photocoagulation; her urine albumin-to-creatinine ratio (ACR) is 1428.0 mcg/mg, indicating diabetic nephropathy; she had been taking an angiotensin-converting enzyme inhibitor for hypertension, but she was switched to nifedipine
- Her pregnancy was unplanned

This case illustrates troubling gaps in care. Justine's high HbA1c levels, insufficient treatment of comorbidities, and use of medications that are unsafe during pregnancy all increase her risk of maternal, fetal, and neonatal complications.

This handout highlights how healthcare providers can best address the special needs of their patients who are pregnant or planning to become pregnant to help ensure that they and their newborns have optimal outcomes, thereby avoiding situations such as Justine's.



## T1D MANAGEMENT BEFORE PREGNANCY

Achieving glycemic targets is one of the primary goals of preconception care because HbA1c levels at conception affect pregnancy outcomes.<sup>1</sup> Higher HbA1c levels during the first trimester are associated with an increased rate of congenital abnormalities.<sup>3</sup> Birth defects can form as early as the first 3 to 6 weeks after ovulation—before most women know they are pregnant—underscoring the importance of controlling BG levels before conceiving.<sup>3</sup> In addition, HbA1c levels of 6.5% or higher during the first trimester are associated with a 4-fold increase in the risk of preeclampsia later in pregnancy.<sup>4</sup>

Recommendations for preconception care are summarized in Table 1.<sup>1,5,7</sup> Importantly, prognostic information gathered during preconception planning can help guide T1D management during and after pregnancy.<sup>5</sup> For example, the presence and extent of retinopathy at conception predicts the risk of progression, with severe forms more likely to deteriorate during and up to 1 year after pregnancy. Women with renal dysfunction at conception also have a higher risk of adverse pregnancy outcomes, including preeclampsia.<sup>5</sup>

**TABLE 1. Preconception Care Checklist for Women with T1D**

<b>ACHIEVE GLYCEMIC TARGETS</b>	<input type="checkbox"/> HbA1c < 6.5% without significant hypoglycemia <input type="checkbox"/> Fasting and pre-meal BG of 80 to 110 mg/dL <input type="checkbox"/> 1-hour postprandial BG of 100 to 155 mg/dL
<b>OPTIMIZE BODY MASS INDEX</b>	<input type="checkbox"/> Lifestyle modifications <input type="checkbox"/> Weight loss of 7% if body mass index is elevated
<b>OPTIMIZE NUTRITION/ VITAMIN INTAKE</b>	<input type="checkbox"/> High-quality diet and low-glycemic-index carbohydrate <input type="checkbox"/> Healthy plate guidelines <input type="checkbox"/> Prenatal vitamins

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**TABLE 1. Preconception Care Checklist for Women with T1D (cont.)**

<b>ASSESS MEDICATIONS</b>	<input type="checkbox"/> Safety for pregnancy <input type="checkbox"/> Discontinue/switch classes as needed
<b>SCREEN FOR RETINOPATHY</b>	<input type="checkbox"/> Obtain ophthalmologist assessment of level of retinopathy and clearance to pursue pregnancy
<b>ACHIEVE BP CONTROL</b>	<input type="checkbox"/> Target BP < 135/85 mm Hg <input type="checkbox"/> Review BP medications; discuss stopping ACE inhibitors/ARBs
<b>MANAGE NEPHROPATHY RISK</b>	<input type="checkbox"/> Monitor BP, serum creatinine, and urine ACR
<b>ASSESS THYROID FUNCTION</b>	<input type="checkbox"/> Target preconception TSH $\leq$ 2.5 in patients with known hypothyroidism
<b>ADDRESS RISK BEHAVIORS</b>	<input type="checkbox"/> Smoking and alcohol use <input type="checkbox"/> Referral for treatment of high-risk behaviors
<b>REFER FOR DIABETES CARE</b>	<input type="checkbox"/> Referral to diabetes pregnancy and specialty care team to support preconception planning and T1D management during pregnancy

## T1D MANAGEMENT DURING PREGNANCY

### Glycemic Targets

The maintenance of glycemic goals during pregnancy is important to reduce the risk of maternal and fetal complications.<sup>1</sup> High BG in the maternal circulatory system is shared with the fetal circulatory system, increasing the risk of excessive fetal growth and large-for-gestational-age (LGA) neonates.<sup>1</sup>

Current guidelines from the American College of Obstetrics and Gynecology (ACOG) and American Diabetes Association (ADA) generally agree on glycemic targets for pregnant women with T1D (Table 2).<sup>6,7</sup> Other groups support tighter goals for some targets, such as 1-hour post-meal BG (100 to 129 mg/dL).<sup>8</sup>

**TABLE 2. Glycemic Targets During Pregnancy**

<b>HbA1c GOAL</b>	< 6.0% without severe hypoglycemia
<b>TIME IN RANGE</b>	> 70% of time within 63 to 140 mg/dL
<b>FASTING AND PRE-MEAL BG</b>	60 to 95 mg/dL
<b>1-HOUR POSTPRANDIAL BG</b>	100 to 140 mg/dL

### Role of Continuous Glucose Monitoring

Glycemic targets are difficult to maintain during pregnancy because of the complexity of insulin dosing, pregnancy-related changes in insulin sensitivity, and pronounced swings in insulin absorption during late pregnancy.<sup>9</sup> In one study, only 14.3% of women with T1D had HbA1c levels lower than 6.5% during early pregnancy, and only 40% were at target by 24 weeks' gestation.<sup>10</sup>

Continuous glucose monitoring (CGM) systems can measure glucose up to 300 times per day, alert users to glucose highs or lows, and display information on glucose trends, enabling patients to respond to changes as they occur.<sup>11</sup> In the CONCEPTT study of CGM use in pregnant women with T1D, CGM users spent more time at target and less time in hyperglycemic ranges than women using capillary glucose monitoring alone.<sup>9</sup> Neonatal outcomes were also better with CGM use during pregnancy—including a lower rate of LGA neonates, fewer neonatal hypoglycemic episodes, fewer intensive care admissions lasting more than 24 hours, and shorter hospital stays—likely due to lower exposure to maternal hyperglycemia.<sup>9</sup>

Despite achieving glycemic goals, however, the risk of excessive fetal growth remains high in pregnancies complicated by T1D.<sup>12</sup> In another study of pregnant women with T1D, CGM use was associated with having mean HbA1c levels of 6.5%, 6.1%, and 6.4% across the first, second, and third trimesters, respectively—yet 63% of neonates in the study were classified as LGA, and the mean birthweight exceeded 4,000 g.<sup>12</sup>

Every tool available is important for maintaining optimal glycemic targets during pregnancy. Even when CGM is being used to monitor glucose trends, patients should test fasting and post-meal BG levels and adjust basal and bolus insulin doses as needed. Furthermore, many CGM devices require calibration with capillary glucose test results 2 to 4 times per day.<sup>11</sup>

### Optimal Insulin Delivery

In those with T1D, insulin requirements change throughout pregnancy, with distinct cumulative peaks and troughs (Table 3).<sup>13</sup> Daily insulin requirements will nearly double by 36 weeks' gestation relative to pre-pregnancy requirements. Frequent and close monitoring with healthcare providers is essential, and understanding these normal patterns is helpful to react to changes in prompt and effective ways.<sup>13</sup>

New technologies that incorporate CGM with insulin delivery systems are now emerging. These automated systems—known as sensor-integrated insulin delivery, closed-loop insulin delivery, and the artificial pancreas—analyze real-time glucose measurements from the CGM to calculate the amount of insulin to deliver via subcutaneous infusion pumps.<sup>11</sup> In a study of pregnant women with T1D, closed-loop insulin delivery improved the proportion of time that BG was within target range by 15.2% compared with standard pump therapy, without an increase in hypoglycemia.<sup>14</sup>

**TABLE 3. Changes in Insulin Requirements During Pregnancy**

	CHANGE PER PERIOD	
	Insulin Dose Requirement (U/kg per day)	Total Insulin Requirement (U/day)
<b>First 9 weeks</b>	↑ 9.1%	↑ 12.1%
<b>9 to 15 weeks</b>	↓ 14.3%	↓ 10.9%
<b>16 to 36 weeks</b>	↑ 71.5%	↑ 94.6%

Data derived from Garcia-Patterson A, Gich I, Amini SB, Catalano PM, de Leiva A, Corcoy R. Insulin requirements throughout pregnancy in women with type 1 diabetes mellitus: three changes of direction. *Diabetologia*. 2010;53(3):446-451.

### Hypertension and Comorbidity Management

As with preconception planning (see Table 1), careful attention to hypertension, retinopathy, nephropathy, and other comorbidities and complications should be continued throughout pregnancy. Antihypertensive and other medications should be confirmed to be safe for use during pregnancy.<sup>2</sup>

### Optimal Nutrition

Proper nutrition is important during preconception care and pregnancy. A subgroup analysis of CONCEPTT showed that pregnant women with T1D had higher-than-recommended intakes of fat and inadequate intakes of fiber, fruit, and vegetables. Although their carbohydrate intake of 180 to 200 g/day was consistent with guideline recommendations, approximately 50% of this intake was derived from non-recommended, high-glycemic sources (eg, sugary/savory snacks, non-alcoholic beverages), which does not align with guideline recommendations and underscores the need for pre- and post-conception medical nutrition therapy.<sup>15-17</sup> Although more research is needed to identify optimal nutrition for pregnant women with T1D, a randomized controlled pilot study of women with gestational diabetes reported that a higher-complex-carbohydrate/lower-fat diet was associated with improved maternal insulin resistance and infant adiposity compared with a low-carbohydrate/higher-fat diet.<sup>18</sup>

### T1D MANAGEMENT AFTER PREGNANCY

Specialized diabetes care should continue into the postpartum period, when women with T1D can experience a substantial decrease of up to 50% of pre-pregnancy insulin requirements.<sup>2</sup> Breastfeeding also contributes to increased insulin sensitivity and the need to adjust insulin dosing. Long-acting reversible contraception should be considered in the immediate post-partum period, before women develop barriers to contraception access.<sup>2</sup>

**IMPORTANT**

#### Women experience postpartum changes in insulin sensitivity:

- Insulin requirements may fall to as low as 50% of preconception needs
- Insulin doses need to be titrated upwards to preconception doses
- Breastfeeding can increase insulin sensitivity

### CASE DISCUSSION

Let's look back on Justine's case. If you were her healthcare provider, what important points would you discuss with her when she returns for a follow-up visit after giving birth?

- ✓ **Birth control**—it will be imperative to make sure Justine understands the importance of avoiding another unplanned pregnancy until reaching her glycemic goals
- ✓ **Preconception care**—if Justine is considering having another child in the future, it will be important to discuss how you will work with her to achieve her glycemic targets and address her diabetes-related complications before becoming pregnant to reduce fetal, neonatal, and maternal risks

## PATIENT EDUCATION RESOURCES



We hope that you found this to be a helpful overview of T1D management before, during, and after pregnancy. The following resource provides additional patient education for women with T1D who are pregnant or planning to become pregnant:  
[www.jdrf.org/t1d-resources/living-with-t1d/pregnancy/](http://www.jdrf.org/t1d-resources/living-with-t1d/pregnancy/).

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