

California Diabetes and Pregnancy Program (CDAPP) Sweet Success Pocket Guide for Professionals ~ 2013

CDAPP Sweet Success strives to prevent adverse outcomes for both the mother and fetus by teaching women who experience diabetes during pregnancy healthy lifestyle behaviors that can result in normoglycemia. This goal is best achieved through intensive interdisciplinary management of diabetes during pregnancy. A full set of CDAPP Sweet Success Guidelines for Care are available from the CDAPP Sweet Success Resource and Training Center at

[www.http://www.cdappsuccess.org/Resources/FreeMaterial.aspx](http://www.cdappsuccess.org/Resources/FreeMaterial.aspx)

Purpose: The purpose of this document is to provide a handy tool for the practitioner to carry and use with diabetic clients before, during, and after pregnancy.

DEFINITIONS

Diabetes is a heterogeneous set of metabolic diseases all characterized by impaired glucose utilization and resulting in hyperglycemia.

Type 1 Diabetes: (no longer known as Insulin Dependent Diabetes Mellitus - IDDM)

- ❖ Accounts for ~ 5% of all diabetes
- ❖ Defect in insulin production - ABSOLUTE deficiency of insulin
- ❖ Autoimmune response destroys insulin producing Beta cells
- ❖ Need exogenous insulin for survival and to prevent DKA

Type 2 Diabetes: (no longer known as Non Insulin Dependent Diabetes Mellitus - NIDDM)

- ❖ Accounts for ~ 95% of all diabetes
- ❖ Often associated with obesity and sedentary life style
- ❖ Characterized by insulin resistance and insulin deficiency
- ❖ Managed by diet & exercise alone, or with oral agents, or with insulin
- ❖ Almost all need insulin for optimum control during pregnancy

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PRE-DIABETES (IFG and/or IGT) - Non Pregnant:

- ❖ HbA1c 5.7 to 6.4
- ❖ IFG: Fasting values that are ≥ 100 mg/dl and < 126 mg/dl
- ❖ IGT: Post load values ≥ 140 mg/dl and < 200 mg/dl, 2 hrs after a 75 gm glucose load

GDM:

- ❖ Accounts for ~ 90% of all diabetes in pregnancy
- ❖ Glucose intolerance first recognized during pregnancy
- ❖ Need diet, exercise \pm insulin/ oral medication for optimum control
- ❖ Predictor of subsequent Type 2 Diabetes
- ❖ Some studies suggest oral meds may be used in lieu of insulin^{1, 2}

GDM A1:

Gestational Diabetes Mellitus controlled with diet and exercise

GDM A2:

Gestational Diabetes Mellitus controlled with diet, exercise and requiring the addition of oral medications and/or insulin

Funding for the California Diabetes and Pregnancy Program (CDAPP) Sweet Success Pocket Guide for Professionals was provided by Federal Title V Block Grant through the California Department of Public Health, Center for Family Health, Maternal, Child, and Adolescent Health Division. ©

The CDAPP Sweet Success Pocket Guide for Professionals, 2013 version, was reviewed by the California Department of Public Health; Maternal, Child and Adolescent Health Division. This 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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For additional information access the CDAPP Sweet Success Resource and Training Center website: <http://www.cdph.ca.gov/programs/CDAPP> or <http://www.cdappsuccess.org>



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California Diabetes and Pregnancy Program

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GLOSSARY OF ACRONYMS & ABBREVIATIONS

BG - Blood Glucose
 BMI - Body Mass Index
 BMS - Behavioral Medicine Specialist
 CDAPP - California Diabetes and Pregnancy Program
 CDE - Certified Diabetes Educator
 CHO - Carbohydrate
 CSII - Continuous Subcutaneous Insulin Infusion (i.e. insulin pump)
 DBW - Desirable Body Weight
 DKA - Diabetic Ketoacidosis
 CVD- Cardiovascular Disease
 DM - Diabetes Mellitus
 EER - Estimated Energy Requirement
 EPDS - Edinburgh Postnatal Depression Scale (available online)
 FPG - Fasting Plasma Glucose
 GDM - Gestational Diabetes Mellitus
 GDM A1 - Gestational Diabetes Mellitus, Diet Controlled
 GDM A2 - Gestational Diabetes Mellitus, Oral Meds/Insulin Controlled
 HbA1c - Glycosylated Hemoglobin
 HTN - Hypertension
 IFG - Impaired Fasting Glucose, AKA pre-diabetes
 IGT - Impaired Glucose Tolerance, AKA pre-diabetes
 MDI - Multiple Daily Injections (of insulin)
 MNT - Medical Nutrition Therapy
 MSW - Master of Social Work
 NSVD - Normal Spontaneous Vaginal Delivery
 OGTT - Oral Glucose Tolerance Test
 PCOS - Polycystic Ovary Syndrome
 RD - Registered Dietitian
 *RDN- Registered Dietitian Nutritionist (new “optional” credential for RD’s)
 SC - Subcutaneous
 SMBG - Self-monitoring of Blood Glucose
 TDD - Total Daily Dose [of insulin]
 * Academy of Nutrition and Dietetics (formally the American Dietetic Association.) “All registered dietitians are nutritionists - but not all nutritionists are RD’s”

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GUIDELINES FOR DIAGNOSIS OF HYPERGLYCEMIA IN PREGNANCY

The following algorithm for screening and diagnosis of hyperglycemia was developed in 2011 and is in agreement with the 2013 American Diabetes Association’s (ADA) Clinical Practice Recommendations³. At the first prenatal visit (< 13 weeks), all pregnant women should undergo risk assessment for diabetes^{3, 4}. Screen either all pregnant women for undiagnosed hyperglycemia or only women with any one of the following risk factors:

Diabetes Risk Factor Identification ADA 2013 Criteria ³
❖ Non-caucasian ethnicity
❖ BMI 25 or higher (the at risk category could be lower in some ethnic groups ⁵)
❖ History of GDM or pre-diabetes, unexplained stillbirth, or malformed infant.
❖ Previous newborn weighing 4000 gms or more (8 lbs 13 oz)
❖ 1st degree relative with DM
❖ Presence of glucosuria
❖ History of PCOS, CVD, HTN, hyperlipidemia
❖ Chronic use of medication that causes hyperglycemia (e.g. steroids, betamimetics, atypical antipsychotics)

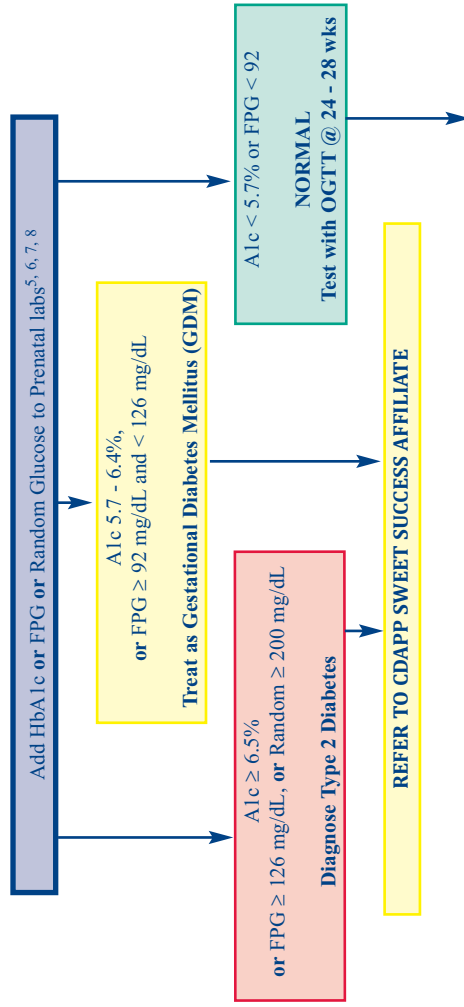
Many practitioners are adding a HbA1c screen to the first trimester prenatal panel.



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5 GUIDELINES FOR DIAGNOSIS OF HYPERGLYCEMIA IN PREGNANCY, CONTINUED



UNIVERSAL TESTING AT 24 - 28 WEEKS^{5, 6, 7, 8}

- ❖ Test all women who were not previously diagnosed with hyperglycemia @ 24-28 weeks gestation with a 75gm 2h OGTT.
- ❖ Fast for 8-10 hours before the test; remain seated during the test. Consider adding to third trimester labs.
- ❖ If entry to care is 13-23 6/7 weeks with risk factors for diabetes, then test ASAP with the 2hr OGTT
- ❖ If any value is at or above cut off, treat as GDM

If results of 75 gm 2h OGTT: FPG: ≥ 92 mg/dL 1 hr: ≥ 180 mg/dL 2 hr: ≥ 153 mg/dl
If any value is at or above cut off, treat as GDM; REFER TO CDAPP SWEET SUCCESS AFFILIATE



SPECIAL TESTS FOR TYPE 1 DIABETES & TYPE 2 DIABETES⁹
(OR EARLY DX GDM OR POOR CONTROL)

	1st Trimester	2nd Trimester	3rd Trimester
HbA1C	X	X	X
Ultrasound	X	18 wks	32 wks
Fetal echo		22 - 24 wks	
Micro albumin - if +, obtain 24 hr urine for total protein, creatinine, creatinine clearance	X	X	X
Thyroid Stimulating Hormone (TSH) - repeat as indicated by results	X		
Ophthalmology exam (repeat each trimester if retinopathy present)	X		
Maternal EKG - age ≥ 35, any DM2, DM1 dx >10 yrs	X		
Fetal Movement (kick counts)			X
Non Stress Test (NST) / Amniotic Fluid Index (AFI)		Women with vasculopathy, HTN, uncontrolled diabetes or ketoacidosis should begin twice weekly testing as early as 28 wks.	If utilizing medication without vasculopathy, begin weekly testing at 32 wks and twice weekly at 36 wks.
Dental Exam	upon entry to care		
Edinburg Postnatal Depression Scale	Initial visit/second trimester, third trimester, 6 weeks postpartum and 3 months postpartum		

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MEAL PLAN

Medical Nutrition Therapy should provide the adequate caloric and nutrient requirements for pregnancy and be culturally appropriate.

- ❖ Obtain RD consult for individualized medical nutrition therapy.
- ❖ CHO controlled diet with at least 175 gms CHO divided into 3 meals and 3 snacks (more CHO as tolerated).
- ❖ Calories based EER formulas for each trimester. Adjust according to maternal parameters and optimal pregnancy weight gain.
- ❖ CHO counting, label reading
- ❖ If on an insulin pump, the meal and snack routine should be individualized.
- ❖ For more information on micro and macro nutrient recommendations, refer to the Medical Nutrition Therapy Chapter of the Guidelines for Care

WEIGHT GAIN RECOMMENDATIONS

Prepregnant BMI Categories & Cut-Offs with Recommended Weight Gain⁹

Weight Category	2009 Institute of Medicine (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	≥ 30.0	11 - 20 lbs	0.5 lbs

*Plot weight gain on the appropriate IOM weight grid

Calculating Body Mass Index*

To calculate BMI using U.S. imperial units:

$$\text{BMI} = 703 \times \frac{\text{Pregravid Weight (lb)}}{\text{Height (in)}^2}$$

Example: Woman is 5'6" & 155 lbs

$$\text{BMI} = 703 \times \frac{155}{(66)^2}$$

$$\text{BMI} = 703 \times \frac{155}{4356}$$

$$\text{BMI} = 703 \times .036$$

$$\text{BMI} = 25$$

* Special efforts need to be made to determine her actual or most accurate pregravid weight (See Chapter 7, Appendix B of Guidelines for Care).

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BEHAVIORAL MEDICINE SPECIALIST

- ❖ Recommended for support with emotional aspects of diabetes management (e.g. stress, changes in lifestyle) for patients and their families as well as psycho/social barriers to adherence and care, e.g. eating disorders, depression, and anxiety.
- ❖ Motivational interviewing is recommended when assessing a patient's readiness for change and learning how to motivate and guide her through her treatment. It allows the BMS to begin where the patient is and to identify and assess one's ambivalence to change. This also allows the patient and the BMS to explore and resolve any ambivalence towards the treatment. Referring to the stages of change model can also be helpful in identifying where the patient is and how to proceed with working with her.
- ❖ Screening with the EPDS during the initial appointment/second trimester, third trimester, six weeks postpartum, and again 3 months postpartum is recommended. A discussion around what the baby blues and postpartum depression are and what the differences are is also recommended throughout her treatment.

EXERCISE

- ❖ 30 - 60 min/day is encouraged to increase insulin sensitivity, etc. If exercise divided into 10 - 20 minutes after each main meal, it will have significant impact on BG.
- ❖ For Type 1 Diabetes monitor BG before, during and after exercise. If glucose is <100 mg/dl prior to exercise, consume carbohydrate to help prevent hypoglycemia.

URINE KETONE TESTING

- ❖ Type 1 Diabetes, Type 2 Diabetes & GDM A2 may check ketones (as directed by the diabetes team) to evaluate adequacy of insulin and CHO intake. Urine ketones should be measured when pregnant diabetic woman is ill or has persistent hyperglycemia > 200 mg/dl.¹⁰
- ❖ Type 1 Diabetes check ketones any time BG is persistently above 200. If ketone levels are moderate or large and BG is above 200, contact health care provider.



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BLOOD GLUCOSE TARGETS DURING PREGNANCY

Fasting/Premeal	60 - 89 mg/dl ¹¹
Peak postprandial	100 - 129 mg/dl ¹²
Mean daily glucose	>87 mg/dl, <100 mg/dl ¹³

(Fastings > 90 was associated with odds ratio 2.73 macrosomia and odds ratio 3.62 C-peptide in the cord >90th % in women with GDM) ¹¹

A1C of < 6.5% prior to pregnancy is associated with reduced rate of congenital malformation. **A1C** of < 6.0 during pregnancy is associated with decreased fetal macrosomia.¹⁰

SELF MONITORING BLOOD GLUCOSE (SMBG)

The **frequency** of testing is determined by whether or not insulin is used.

GDM A1: Check FBG and 1-hour postprandial BG. Testing may be reduced according to BG control.

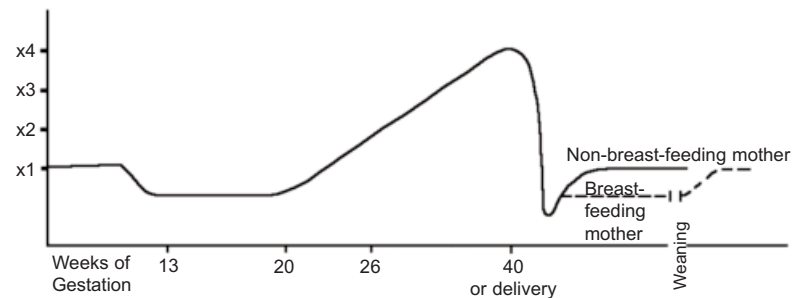
GDM A2: Check FBG and 1-hour postprandial BG. Check pre-prandial, bedtime, and 2 - 3 am as needed and directed.

Type 2 Diabetes on multiple injections of insulin: same as GDM A2

Type 1 Diabetes on CSII or MDI: Check pre and post meal and snacks, bedtime and 3 am (as needed).

The 1-hour post meal BG check should be timed from the first bite of the meal.

INSULIN REQUIREMENTS DURING PREGNANCY¹⁴



CONDITIONS THAT INCREASE INSULIN NEEDS

Insulin doses must be increased to overcome a reduction in sensitivity for the following conditions:^{15, 16}

- ❖ 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. urinary tract infections, 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.¹⁵ Refer to Appendix I for an algorithm of changes in insulin dosing during betamethasone treatment.¹⁶

INSULIN DOSE AND REGIMEN

Insulin dose and regimen (Subcutaneous) is individualized based on type of DM, blood glucose control, and gestational age. The following table includes recommendations for women with Type 1 Diabetes, Type 2 Diabetes and uncontrolled GDM.

CALCULATING INSULIN DOSES ¹⁷ for Multiple Daily Injections (MDI) for Type 1 and Type 2 Diabetes During Pregnancy

1. Calculate body weight in kilograms Current weight in pounds divided by 2.2 =	(a) _____ kg
2. Identify pre-pregnant BMI category (using Appendix G, Body Mass Index Table, or the link: www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/english_bmi_calculator/bmi_calculator.html)	BMI _____
3. Determine units/kg of insulin required using table below starting with the patient's gestational age. Then use Type 1 column if they have type 1 diabetes (b) OR 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 (c) .	(b) _____ units/kg OR (c) _____ units/kg
Gestational age	Type 1
	Type 2/ obese Type 1, uncontrolled GDM
Pre pregnant	0.4-0.55 units/kg
Week 1–17	0.3-0.5 units/kg
Week 18–24	0.6-0.7 units/kg
Week 25–32	0.8-0.9 units/kg
Week 33–38	0.9-1.0 units/kg
Post partum	0.3-0.5 units/kg
4. Calculate Total Daily Dose (TDD): Patient's weight in kg (a) X (b) OR (c) _____ units /kg =	(d) _____ units

5. Calculate BASAL INSULIN Dose TDD (d) X 0.5 = total daily basal insulin (e) Then adjust total basal insulin dose (e) 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 (e) in half and give one half at bedtime (f) and the second half 12 hours later. Total daily basal insulin (e) divided by 2 = _____ units/at bedtime (f) & _____ units to 12 hrs later OR B. if using intermediate NPH, use one half total daily basal insulin (e) 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 (e) divided by 2 = _____ units/at bedtime (g) The second half dose of (e) 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 TDD (d) X 0.5 = _____ total daily bolus insulin (h) 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). 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. The patient needs to consult with her physician or health care professional to determine the I:CR. 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 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)	(h) Total daily bolus _____ units _____ I:CR ratio (i) _____ units B: _____ units L: _____ units D: _____ units

INSULIN DOSE AND REGIMEN - QUICK START

Another method, Quick Start, is to use bedtime basal insulin 0.2 units/kg and premeal bolus rapid-acting insulin analog 0.25 units/kg divided over 3 meals with more at breakfast to account for greater insulin resistance upon rising. These doses are adjusted frequently, every 2-3 days, according to pre and postmeal blood glucose levels. Morning or lunchtime basal insulin can be added in small doses if prelunch, predinner or bedtime glucoses are elevated. Quick start is based on a fixed carbohydrate intake at each meal. See step 6 of the previous table, Calculating Insulin Doses, for more information (page 12). Over time, optimal control can be achieved by determining insulin to carbohydrate ratios to increase flexibility of carbohydrate intake. A premeal correction algorithm may be added (see table: Suggested Premeal Correction Algorithm on page 15)

Example of Basal/Bolus Insulin Dosing Quick Start ¹⁸ 60 kg @ 10 weeks gestation	
Bolus premeal rapid acting analog (lispro, apidra, aspart) = 0.25 x 60 (kg) = 15	Basal insulin 0.2 x 60 (kg) = 12 units @ bedtime
Prebreakfast 7 units	If needed add small doses basal insulin prebreakfast and prelunch. May use wt based calculation minus above dose i.e. 60kg x 0.7units/kg = 42 units TDD divided by 50%= 21 units for basal insulin minus 12 units for bedtime dose = 9 units to be divided through out the day. EX. Prebreakfast = 5 units NPH, prelunch = 4 units NPH. If using detemir (Levemir), dose may be divided into two doses, two thirds at bedtime one third twelve hours later.
Prelunch 4 units	
Predinner 4 units	

INSULIN DOSE AND REGIMEN, CONTINUED

For women with GDM, initiate insulin therapy with mild hyperglycemia when 1/3 of post-meal values are ≥ 130 and <180 , or 1/3 of fasting values are ≥ 90 and <120 . Consider the following:

Insulin for GDM ¹⁹	
Glucose Value	Insulin Dose
Fasting (FPG) >90 mg/dl, <120 mg/dl	Start with 8 - 20 NPH or levemir @ bedtime using 0.2 units/kg actual body weight.
1-hour post breakfast >130 mg/dl, <180 mg/dl	2 - 4 units of rapid acting analog (i.e. Novolog, Humalog, Apidra) pre-breakfast
1-hour post lunch >130 mg/dl, <180 mg/dl	2 - 4 units rapid acting analog pre-lunch OR Add 4 - 6 units NPH to pre-breakfast injection (and eat lunch 4 - 5 hrs after breakfast)
1-hour post dinner >130 mg/dl, <180 mg/dl	2 - 4 units rapid acting analog pre-dinner.



DO NOT USE POST MEAL SLIDING SCALE^{20, 21} insulin as this practice leads to over treatment without avoiding fetal exposure to hyperglycemia. Use a premeal insulin correction algorithm to adjust rapid acting insulin when premeal glucoses are not within target.

SUGGESTED PREMEAL CORRECTION ALGORITHM - MDI²²

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

ORAL MEDICATIONS - SUGGESTED DOSING

Women utilizing oral hypoglycemic agents should continue diet, exercise, SMBG, fetal surveillance as with insulin management

Glyburide Protocol ²

- ❖ 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.

Metformin Protocol ^{23, 24, 25}

- ❖ 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.



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INSULIN ADJUSTMENTS DURING BETAMETHASONE (BMZ) USE ALGORITHM^{16, 17}

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 (±) 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
<p>For example: 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 & 4 = half of insulin increase + TDD insulin dose = 25 + 50 = 75 units Day 5 = revert to TDD insulin dose = 50 units</p>			
This algorithm must be individualized to patient response			

TOCOLYTIC THERAPY

Avoid Betamimetics, use Nifedipine or Magnesium Sulfate if necessary.

TREATMENT OF HYPOGLYCEMIA - RULE OF 15²⁶

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

TREATING HYPERGLYCEMIA AND HYPOGLYCEMIA WHEN NPO^{27, 28, 29}

Note: Hyperglycemia and Hypoglycemia can be avoided by frequent (no less than hourly) blood glucose checks.

Treating **Hyperglycemia**

Consider source of elevated blood glucose: fever, infection, betamimetics (ephedrine or terbutaline), pain or anxiety, and treat the source. If **blood glucose target of 70-110** are not achieved within 2 hours of insulin adjustments, modify IV insulin per the algorithm on page 15.

Treating **Hypoglycemia** (Notify physician)

If current blood **glucose is 50 to 70 mg/dL**:

- ❖ Stop insulin infusion (either Drip-CIII or Pump-CSII).
- ❖ Infuse IV D5 solution at 200 ml/hr.
- ❖ Check blood glucose every 15 min until >70 mg/dL x 2.
- ❖ When blood glucose is 70 mg/dL, restart insulin infusion at a lower algorithm and reduce D5 to 100 ml/hr.

If current blood **glucose is less than 50 mg/dL**:

- ❖ STOP insulin infusion (either Drip-CIII or Pump-CSII),
- ❖ Infuse D10 solution at 200 ml/hr,
- ❖ Check blood glucose every 15 min until >70 mg/dL x 2,
- ❖ 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
- ❖ When blood glucose is 70 mg/dL, restart insulin infusion at a lower algorithm and reduce D5 to 100 ml/hr.

Avoid Glucagon unless the patient is losing consciousness and IV access is lost. Glucagon can cause nausea and vomiting, and it will block insulin for hours allowing the blood glucose to surge above 200 mg/dL. Turn woman on her side.



MANAGEMENT OF GDM DURING LABOR & DELIVERY 27, 28, 30, 31

CRITICAL POINTS	GDM A1 (diet and exercise controlled)	GDM A2 (requires addition of oral agents and/or insulin for control)
Assess all women admitted to the labor and delivery unit for the content and time of the last meal eaten. Careful attention should be directed towards carbohydrate (CHO) intake whether oral or intravenous. Rapid infusion of glucose should be avoided as this will cause fetal hyperinsulinemia.	D I E T <u>Early labor:</u> CHO controlled diet as per pregnancy <u>Active labor:</u> If clear liquids: Use <u>CHO controlled</u> liquids If BG is <100mg/dL use 30 gms CHO every 2-3 hours If BG >100mg/dL use non-caloric clear liquids If NPO: Have LR as main line with D5 IVPB connected close to insertion site of LR If BG <100 mg/dL use IV D5 @ 100 mL per hour If BG is >100 mg/dL use LR @ 100 ml per hour	 <u>Early labor:</u> CHO controlled diet as per pregnancy <u>Active labor:</u> If clear liquids: Use <u>non caloric</u> clear liquids If NPO: Have LR as main line with D5 IVPB connected close to insertion site of LR If BG <100 mg/dL use IV D5 @ 100 ml per hour If BG is >100 mg/dL use LR @ 100 ml per hour

CRITICAL POINTS	GDM A1 (diet and exercise controlled)	GDM A2 (requires addition of oral agents and/or insulin for control)
Obtain BG on admission Frequent monitoring of BG is the key to maintaining normoglycemia during labor.	B L O O D G L U C O S E (B G) M O N I T O R I N G <u>Early labor:</u> While eating: Check FBG and 1 hour after start of meals <u>Active labor:</u> Check BG every 2 hours and just before delivery	 <u>Early labor:</u> While eating: Check FBG and 1 hour after start of meals. <u>Active labor:</u> Check BG every 1-2 hours. When on IV insulin, check every 1 hour or more. Check just before delivery.
Assess all women admitted to the labor and delivery unit requiring insulin or oral agents for the time, type and dose of oral medication or insulin taken. If insulin is required the most effective way to achieve glycemic control is to use insulin by intravenous route.	M E D I C A T I O N 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.	Discontinue oral agents for glucose control on day of induction or with onset of labor. Women with GDM A2 may or may not require insulin in labor If BG >110mg/dL, remove glucose source. Repeat BG in 30 minutes If BG remains >110 mg/dL, then IV insulin should be initiated

GLYCEMIC CONTROL FOR PREEEXISTING DIABETES

Clinical Actions to Maintain Maternal Euglycemia Using Continuous Intravenous Insulin Infusion (CIII) Drip for Women with Preexisting Diabetes^{28, 32}

NOTE: For induction of labor in the morning, the usual dose of NPH insulin is given at bedtime the night before but the morning dose of NPH insulin is withheld.

❖ Obtain baseline blood glucose to confirm blood glucose is >70 mg/dL or <110 mg/dL.

❖ In early labor, clear NON CALORIC liquids may be taken. If carbohydrates are needed, use intravenous dextrose (D5 1/2 NS) as a carbohydrate source, controlled by an infusion device. This equals 5 grams dextrose per 100 mL of 1/2 normal saline. Women with gastroparesis must be NPO throughout labor.

❖ Start main IV with 1000 ml LR at a rate of 50 ml/hr (or 100 ml/hr if not infusing glucose).

❖ Initiate insulin infusion when blood glucose is >70 mg/dL for type 1 diabetes; or blood glucose is 91-110 mg/dL for type 2 diabetes. **NOTE:** Insulin sticks to the IV tubing therefore, 10-20 ml of the insulin solution must be flushed through the tubing prior to beginning the insulin infusion.

❖ Check blood glucose every 30 minutes until close to 100 mg/dL. Adjust drip dose according to algorithm depicted in page 20. When blood glucose is stable at 100 mg/dL, BG checks can be done once per hour. Anytime blood glucose is out of the target range it is checked every 15 to 30 minutes.

❖ If blood glucose is <100 mg/dL, begin infusion with 1000 ml D5LR (or D5NS) at 100 ml/hr using an intravenous infusion controller device.

❖ Observe for signs of hypoglycemia and if present, check blood glucose levels immediately. If blood glucose is <70 mg/dL, stop insulin infusion and treat for hypoglycemia. Refer to page 18, Treating Hyper/Hypoglycemia

❖ 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 stopped.

CONTINUOUS INTRAVENOUS INSULIN INFUSION (CIII) - DRIP INTRAPARTUM AND POSTPARTUM ALGORITHM ^{27, 28}

- ❖ Check blood glucose on admission and every hour while on insulin drip. Discontinue all SC insulin.
- ❖ Begin IV fluids as follows: BG >130-LR @ 125/h; BG <130 D5 1/2 NS or D5LR @ 100 - 125/h
- ❖ NPO or non-CHO containing clear liquids

	INTRAPARTUM	POSTPARTUM
Blood glucose (mg/dL)	Units of insulin in ml/hr	Units of Insulin in ml/hr
Blood glucose target 70-110	100 units Regular human insulin in 100 ml NS (1ml = 1unit insulin)	
<70 (treat for hypoglycemia)	0	0
71-90- Start for type 1 diabetes	0.5 ml/hr	0
91-110- Start for type 2 diabetes	1 ml/hr	0.5 ml/hr
111-130 - Start for GDM A2	2 ml/hr	1 ml/hr
131-150	3 ml/hr	1.5 ml/hr
151-170	4 ml/hr	2 ml/hr
171-190	5 ml/hr	2.5 ml/hr
>190	Assess urine for ketones, call MD for insulin dose	

GENERAL PRINCIPALS OF CONTINUOUS SUBCUTANEOUS INSULIN INFUSION (CSII) - PUMP^{33, 34, 35}

- ❖ 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; 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.

POSTPARTUM PROTOCOL FOR INPATIENT DIABETES CARE 28, 36, 37, 38, 39, 40, 41, 42, 43, 44,45

Insulin needs are less postpartum and are generally out in half. Therapy goal is to keep BG in the following ranges: **For women with GDM: 1h postprandial < 140 mg/d**
For women with Preexisting DM 2h postprandial < 160 mg/d

GDM A1 (diet and exercise controlled)	GDM A2 (requires addition of oral agents and/or insulin)	Type 1 or Type 2 Diabetes Vaginal Birth	Type 1 or Type 2 Diabetes Cesarean Section (NPO)
<p>When eating: Resume healthy diet using same caloric allotment as pregnancy for breastfeeding. If BG <130 mg/dL may use IV D5 @ 100 ml per hour If BG is > 130 mg/dL use LR @ 100 ml per hour</p>			
DIET			
<ul style="list-style-type: none"> At least 1 fasting, and 1 one hour after a meal before discharge 	<ul style="list-style-type: none"> Resume healthy diet using same caloric allotment as pregnancy for breastfeeding. If BG <130 mg/dL may use IV D5 @ 100 ml per hour If BG is > 130 mg/dL use LR @ 100 ml per hour 	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> 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. 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.
BLOOD GLUCOSE MONITORING			
<ul style="list-style-type: none"> At least 1 fasting, and 1 one hour after a meal before discharge 	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> Check BG every 1-2 hours while on IV insulin infusion, continue to adjust the dose according to half the labor algorithm. Check BG with vital signs during recovery & on admission to Postpartum unit Check frequently in the first few days postpartum; insulin needs change rapidly especially with breastfeeding (before/after breastfeeding, any time a nap is planned after breastfeeding) Check BG at 3 AM, fasting, before meals, two hours after meals, and at bedtime 	<ul style="list-style-type: none"> Check BG every 1-2 hours while on IV insulin infusion, continue to adjust the dose according to half the labor algorithm. Check BG with vital signs during recovery & on admission to Postpartum unit Check frequently in the first few days postpartum; insulin needs change rapidly especially with breastfeeding (before/after breastfeeding, any time a nap is planned after breastfeeding) Check BG at 3 AM, fasting, before meals, two hours after meals, and at bedtime

GDM A1 (diet and exercise controlled)	GDM A2 (requires addition of oral agents and/or insulin)	Type 1 or Type 2 Diabetes Vaginal Birth	Type 1 or Type 2 Diabetes Cesarean Section (NPO)
<p>Glucose lowering medications not needed</p> <ul style="list-style-type: none"> There is rarely a need for subcutaneous insulin postpartum. May consider use of Metformin if medication is needed to bring BG into normal range. Metformin use in breastfeeding was found to be efficacious. 			
MEDICATION			
<ul style="list-style-type: none"> Glucose lowering medications not needed 	<ul style="list-style-type: none"> There is rarely a need for subcutaneous insulin postpartum. May consider use of Metformin if medication is needed to bring BG into normal range. Metformin use in breastfeeding was found to be efficacious. 	<ul style="list-style-type: none"> Discontinue the insulin drip (CIII) when blood glucose is <140 mg/dL or reset all pump parameters to one-third of the pregnancy dose. Discontinue the dextrose infusion when blood glucose is >80 mg/dl 	<ul style="list-style-type: none"> For type 1 diabetes, continue IV insulin infusion (drip-CIII) at half the algorithm (pg 15) 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. Continue dextrose infusion @ 100 ml/hr or a rate to keep blood glucose <140 mg/dL. Women 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. 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).
BREASTFEEDING			
<p>Breastfeed early (preferably in the first 1/2 hour of life) and often (10-12 times per 24 hours). Women who undergo cesarean birth should not be an exception. Breastfeeding can reduce the risk of hypoglycemia for the newborn and has been shown to reduce the risk of type 2 diabetes in the mother and baby.</p> <ul style="list-style-type: none"> Check blood glucose often in the first few days postpartum as insulin needs rapidly change especially with breastfeeding Provide needed care (physical assessment/glucose monitoring) without separating couplet. 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. 			

POSTPARTUM FOLLOW-UP AFTER DISCHARGE^{17, 39, 43, 46, 47, 48, 49, 50}

Preexisting Diabetes	Gestational Diabetes
MONITORING BLOOD GLUCOSE	
<ul style="list-style-type: none"> Maintain blood glucose within these targets while breastfeeding: Fasting/premeal <110mg/dL 2 hour postmeal <150 -170mg/dL Target if not breastfeeding: Fasting/premeal <120mg/dL 2 hour postmeal <180mg/dL Once blood glucose and medication management are stabilized, check blood glucose fasting, before meals and at bedtime. Post meal testing as indicated. <p>Although CDAPP Sweet Success Affiliates may provide care until 6 weeks postpartum, a primary care provider should be available.</p>	<p>Women with GDM should be screened for diabetes with a 75 g, 2-hr OGTT at 6-12 weeks (before 3 months) postpartum; or after 3 months postpartum, an A1c should be done to determine her diabetic status.</p> <ul style="list-style-type: none"> If the screen is normal, repeat at 1 year after delivery & every three years thereafter as long as values remain within normal limits. Encourage women to obtain a glucose screen before conceiving again.
HEALTHY EATING	
<ul style="list-style-type: none"> Postpartum follow up at 2-6 weeks with RD to reinforce a meal plan that incorporates principals of healthy meal and lifestyle. Encourage attainment of a healthy BMI. Adjust meal plan as needed to accommodate breastfeeding needs and weight goals. 	<ul style="list-style-type: none"> Resume healthy diet using same caloric allotment as was used during pregnancy if breastfeeding.
STAYING ACTIVE	
<ul style="list-style-type: none"> With medical approval, encourage 30-60 minutes per day, everyday, of brisk activity, such as walking, swimming stationary cycling etc. 	
HEALTHY COPING	
<ul style="list-style-type: none"> Encourage use of family & social support system (mothers groups etc.). Assess ability to provide care for self and infant. Assess with Edinburgh Postnatal Depression Scale at 6 weeks postpartum and again at 3 months postpartum. 	

Preexisting Diabetes	Gestational Diabetes
TAKING MEDICATIONS	
<ul style="list-style-type: none"> Maintain contact with provider throughout the first 6 weeks postpartum as insulin or oral hypoglycemic medication needs drop or change frequently. Metformin and glyburide are considered safe for breastfeeding. Women who utilized antihypertensive therapy or lipid lowering medication, should consult with their physician regarding the medication and breastfeeding. 	<p>If prediabetes, Impaired Glucose Tolerance (IGT) or Impaired Fasting Glucose (IFG) is diagnosed, refer for aggressive lifestyle change. Including: 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.</p>
PROBLEM SOLVING	
<p>Advise the woman to notify the primary physician who provides her diabetes care outside of pregnancy regarding the outcome of her pregnancy and schedule a follow up appointment.</p>	<p>Women who had GDM should:</p> <ul style="list-style-type: none"> -be alerted to signs/ symptoms of diabetes (e.g. increased thirst & urination, repeat vaginal yeast infections, etc). -space future pregnancies at least 2 years apart and obtain a 75 g, 2-hour OGTT or A1c before pregnancy and screen for hyperglycemia at the first prenatal visit.
REDUCING RISKS	
<ul style="list-style-type: none"> Continue normal diabetic care. Obtain HbA1C, lipids and TSH at 6 months postpartum or sooner if indicated. Target values: <ul style="list-style-type: none"> HbA1C <7% LDL <100mg/dL HDL >50 mg/dL TGs <150mg/dL 	<ul style="list-style-type: none"> Evaluate for metabolic risk factors 1 year after delivery and yearly thereafter. Follow AACE and NCEP U.S. Preventive Services Task Force (USPSTF) recommendations for testing and evaluation such as lipids, waist-hip ratio, etc.
<ul style="list-style-type: none"> Breastfeed for at least 6 months, preferably for 1 year. Plan future pregnancies; delaying pregnancy for 2 years is recommended <p>Progestin only hormonal methods will increase glucose intolerance for preexisting DM and may require medication adjustment.</p> <p>Progestin only hormonal methods are not recommended for GDM as they will nearly triple the diabetes diagnosis above women using non-hormonal methods while breastfeeding.</p>	



Funding for the CDAPP Sweet Success Pocket Guide for Professionals was provided by Federal Title V Block Grant through the California Department of Public Health, Center for Family Health, Maternal, Child, and Adolescent Health Division. © For additional information access the CDAPP Sweet Success Resource and Training Center website: <http://www.cdappssweetsuccess.org>

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Special thanks to Larry Gavin, MD, Jack Kitzmiller, MD, and Maribeth Inturrisi, RN, MS, CDE, for original concept (1992) which formed the base for the 2008 CDAPP Sweet Success Pocket Guide. Updated 2013.

Funding for the CDAPP Sweet Success Pocket Guide for Professionals was provided by Federal Title V Block Grant through the California Department of Public Health, Center for Family Health, Maternal, Child, and Adolescent Health Division.© For additional information access the CDAPP Sweet Success Resource and Training Center website: <http://www.cdappsweetsuccess.org>

