2/23/19njm

ANMC OB/GYN Service
Diabetes Mellitus in Pregnancy
Screening and Management Guidelines

I. Introduction

In the last 2 generations diabetes in pregnancy has increased significantly in Alaska Natives. Diabetes can be associated with morbidity and mortality for both the pregnant patient and her offspring. Management of diabetes in pregnancy offers a unique opportunity to positively impact both patients' lives.

With the publication of the Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study and the subsequent International Association of Diabetes and Pregnancy Study Groups (IADPSG) diagnostic criteria we now have randomized controlled data to guide management. While awaiting other national benchmark recommendations, the Alaska Area, in cooperation with national Indian Health Diabetes Program, suggests the following guidelines.

II. Screening and Diagnostic Procedures

A. Patients with pre-gestational diabetes do not require gestational diabetes testing. Proceed directly to Management Plan. Do not perform glucose challenge testing or further screening.

B. If the patient does not tolerate the standard glucose solution, there are several alternative modalities. (Appendix A)

C. Initial Phase: Screening for overt diabetes

All patients should be screened at their initial visit to rule out overt diabetes as defined by the American Diabetes Association (ADA) criteria listed in Table 1.

If the patient is <u>not fasting</u>, then obtain these:

Hgb A1C
Random plasma glucose

If the patient is <u>fasting</u> then obtain these:
Fasting plasma glucose
Hgb A1C

Table 1
Diagnosis of overt diabetes in pregnancy

Measure of glycemia	Consensus threshold
Fasting plasma glucose	≥ 126 mg/dl
A1C	≥6.5%
Random plasma glucose	≥ 200 mg/dl + confirmation*

*A tentative diagnosis of overt diabetes based on measurement of random plasma glucose must be confirmed with either an FPG or A1C value greater than or equal to the threshold using a standardized/aligned method.

As there is no standardized method to screen for GDM prior to 24 weeks, one is limited to the DM criteria above for at risk patients. (See Table 2)

Table 2
At risk patients prior to 24 wks gestation

Additional testing can be considered in overweight (BMI ≥25 kg/m2) or obese adults who have one or more of the following risk factors:

First-degree relative with diabetes
High-risk race/ethnicity (e.g., African American, Latino, Native American, Asian American, Pacific Islander)
Previous gestational diabetes mellitus
Women with polycystic ovary syndrome
Previous infant weighing > 4000 g at birth
Prediabetes (A1C ≥5.7%, IGT, or IFG)
History of cardiovascular disease
Hypertension (≥140/90 mmHg or on therapy for hypertension)
HDL cholesterol level <35 mg/dL and/or a triglyceride level >250 mg/dL
Other clinical conditions associated with insulin resistance (e.g., pre-pregnancy BMI > 40, acanthosis nigricans)

(From Table 2.3 Classification and Diagnosis of Diabetes American Diabetes Association Diabetes Care 2017 Jan; 40(Supplement 1): S11-S24 and Box 1 ACOG Practice Bulletin.)

As the patient will have had a HgbA1c and an RBS at initial booking, the remaining standardized DM test to obtain for the majority of patients is a FBS, using an Adult DM FBS cut-off of 126 mg/dL.

Exception:
ACOG does not encourage repetitive OGTTs, so an OGTT performed prior to 24 wks should be limited to:
-documented prior insulin resistance with repeated 2 hr postprandial levels 140-199 mg/dL, e.g., PCOS

-In this case the adult OGTT result should be evaluated by Adult ADA DM criteria, e. g., neither pregnant OGTT method, nor pregnancy GDM criteria should be used.

If patient enrollment is at ≥ 24 weeks' gestation and overt diabetes is not found by initial booking labs, then the patient should proceed directly to a 75-g OGTT and evaluated by the criteria in Table 3.

D. Second Phase: Diagnosis of Gestational Diabetes

The second phase is a 75-g OGTT at 24–28 weeks' gestation in all women not previously found to have overt diabetes or GDM. Table 3 presents the 2010 International Association of Diabetes and Pregnancy Study Groups (IADPSG) criteria based on the Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study.

The patients should be given a 2 hr 75 g OGTT (75 gm anhydrous glucose dissolved in water) post an 8-14 hour fast after 3 days of unrestricted carbohydrate diet as follows:

1. Draw a fasting venous blood sample.

2. Administer a 75 gram oral glucose load.

3. Draw venous blood samples at one and two hours.

Only one of these values from a 75-g OGTT must be equaled or exceeded for the diagnosis of GDM.

Table 3
Threshold values for diagnosis of gestational diabetes mellitus

Glucose measure	mg/dl
FPG	≥ 92
1-h plasma glucose	≥ 180
2-h plasma glucose	≥ 153

Please note: These are essentially third trimester GDM criteria in Table 3 so they can be used throughout the remaining pregnancy, just not before 24 weeks.

To recap

Strategy for the detection and diagnosis of hyperglycemia disorders in pregnancy

First prenatal visit
Measure random plasma glucose and A1C on all patients (or FBS patient was fasting)
If results indicate overt diabetes as per Table 1
-Treatment and follow-up as for preexisting diabetes

Next visit
If initial results are not diagnostic of overt diabetes as per Table 1 and the patient is at risk (Table 2), then perform a FBS if not already done. Evaluate that FBS by DM criteria, not GDM criteria.

24–28 weeks' gestation: diagnosis of GDM

2-h 75-g OGTT:	perform after overnight fast on all women not previously found to have overt diabetes or GDM during testing earlier in this pregnancy
Overt diabetes	-if fasting plasma glucose 126 mg/dl
GDM	-if one or more values equals or exceeds thresholds indicated in Table 3
Normal	-if all values on OGTT less than thresholds indicated in Table 3

III. .Management Categories of Gestational Diabetes

These next two sections refer to diabetes diagnosed during this pregnancy.
Please note there are later sections on pre-existing diabetes, Type I DM, and Class B (and above) diabetes in pregnancy

Gestational Diabetes Classification

Class	Fasting Glucose Level		2 hr Post prandial Glucose
A-1	< 95 mg/dL	and	< 120 mg/dL
A-2	≥ 95 mg/dL	and/or	≥ 120 mg/dL

A. Class A-1 patients are those who can achieve the above glycemic control with diet alone. Patients in this class may deteriorate to Class A-2. Management should then be changed accordingly.

B. Class A-2 patients are those who require insulin or hypoglycemic therapy to achieve the above level of control. Prior to initiating insulin or hypoglycemic therapy, the patient should have been treated with at least 2 weeks of Medical Nutrition Therapy (MNT) after consultation with a skilled nutrition counselor.

IV. Management - Class A-1 (diet controlled)

A. Exercise:

The patient should receive an exercise consult. In the meantime the patient should be encouraged to exercise at least 3-4 times weekly for 20 – 30 minutes per session. Brisk walking is ideal.

Please note this is a Level A Recommendation
Moderate exercise of 60-150 minutes per week divided 3x / wk improves glucose control.
(See Appendix F: Exercise guidelines to improve glucose control)

B. Diet:

Please note: These are general recommendations.
Your, or your nutrition counselor, should individualize these recommendations to the reality of each specific patient's home environment.
The following counseling should be reality based and allow enough leeway so the patient feels she is in control of this process.

1. Nutrition consult:

   a. initial to include diet recall.
   b. periodic follow-up with nutritionist if possible.

2. A diet of 30 kcal / kg, or 2,200 calories, is recommended for those patients whose initial BMI is < 30.

3. For those patients who have a BMI ≥ 30 on their initial visit, a diet of 25 kcal / kg pre-pregnancy ideal body weight, can be calculated. In these patients, restrict carbohydrate to 35-40% of the total calories.

4. In Medical Nutritional Therapy source of calories can be divided as:

   a. 40% carbohydrates, especially complex unrefined carbohydrates
   b. 20% protein
   c. 40 % fat
      -less than 10% saturated fats;
      -up to 10% polyunsaturated fatty acids. The rest of the fats can come from mono-unsaturated sources.
      Traditional native diet include: muktuk, hooligan, oogruk- air-dried bearded seal meat, oogruk oil, dried salmon, walrus meat, walrus skin, walrus fat, bowhead whale meat and fat.
      (See Appendix E: Gestational Diabetes Traditional Alaskan Foods Meal Plan with Milk)

5. Calories can be distributed as:

   a. 10-15% breakfast
   b. 5-10 % snack
   c. 20-30 % lunch
   c. 5-10% snack
   d. 30-40% dinner
   e. 5-10 % bedtime snack.

6. The 2009 IOM objectives for weight gain are:

Recommendations for singleton pregnancy:

- BMI <18.5 kg/m2 (underweight) weight gain 28 to 40 lbs (12.5 to 18.0 kg)
- BMI 18.5 to 24.9 kg/m2 (normal weight) weight gain 25 to 35 lbs (11.5 to 16.0 kg)
- BMI 25.0 to 29.9 kg/m2 (overweight) weight gain 15 to 25 lbs (7.0 to 11.5 kg)
- BMI ≥30.0 kg/m2 (obese) weight gain 11 to 20 lbs (5 to 9.0 kg)

a. these goals should be maintained without ketosis, if ketones are

noted, have patient check urine QID x1-2 days and report results

b. pregnancy is not the time for weight loss.

7. Sugar substitutes are considered "Generally safe in pregnancy"

C. Clinic Management:

1. Frequency of visits
   a. at least weekly until glucose control established
   b. every four weeks until 36 weeks gestation
   c. weekly after 36 weeks gestation.

2. Initial nutrition consult, then repeat prior to addition of insulin, or hypoglycemic

3. Exercise therapy: Please note this is a Level A Recommendation
   Moderate exercise of 60-150 minutes per week divided 3x / wk improves glucose control. (See Appendix F: Exercise guidelines to improve glucose control)

4. Home glucose monitoring should be taught to all women with GDM, and equipment (machine and strips) supplied. Frequency of monitoring should be QID (fasting, and either 1 hrs. or 2 hrs. after meals) initially. Individualize the schedule based on initial few days' results.

A. Glucose goals
   The current meters sample an ultrafiltrate of plasma from a whole blood* capillary specimen. The following are criteria are based on the plasma reading from those meters

   Goals of management should be maintenance of > 50% of glucose levels at
   a. fasting glucose ≤ 95 mg/dL,
   or
   b. 1 hour post prandial glucose ≤ 140 mg/dL
   or
   c. 2 hour post prandial glucose ≤ 120 mg/dL.

* in prior iterations of the monitors, the whole blood reading was adjusted to reflect that plasma readings are usually about 11% higher than whole blood

If the patient does not provide adequate fingerstick data, then:
-obtain a point of care (POC) glucose at each visit, if
> 120 mg/dL (if last oral intake was over two hrs prior)
> 140 mg/dL (if last oral intake was over one hr prior, but less than 2 hrs)
-obtain a Hgb A1c, if
≥ 6.0 %
-obtain an US (if last US was greater than 3 wks). If
AC > 75th percentile
EFW > 95th percentile
then discuss the need for a management change

B. Periodic lab work
Women with BMI > 30 treated with diet restriction only
-ketone measurement may be helpful
Otherwise there is no role for routine urine testing

1. Ultrasound for precise dating prior to 18 weeks in combination with careful clinical dating. Anatomy scans should be done at 20-22 wks.

2. Repeat ultrasound at 28-33 weeks to include abdominal circumference. If

abdominal circumference > 90th percentile or greater than 3 wks beyond EGA, (See Appendix G) then consider NPH insulin therapy.

a.

EGA	Hadlock Abdominal Circumference 90th Percentile
28	26.0
29	27.2
30	28.3
31	29.4
32	30.4
33	31.5

b. Start NPH at 0.5 units/kg, divided 2/3 in AM and 1/3 at HS and adjust

3. Daily fetal movement count - begin at 32 weeks. No regular NSTs are necessary

4. Consult OB-GYN if any of these factors are noted:

   a. increased blood pressure
   b. prior stillbirth
   c. marked decrease in fetal movement

5. When glucose control is adequate and no other complications supervene, there is no good evidence to support routine delivery before 40 weeks

D. Intrapartum Management:

Alaska Native Medical Center (ANMC) OB-GYN department recommends transfer of any pregnant woman with GDM at 37 weeks not controlled within the above parameters to a facility with an OB/GYN on site. In situations where exceptions are made, specific consultation on labor management is advised

At ANMC Class A1 patients should be evaluated for delivery at 40-41 weeks.

Class A1 patients with >50% of glucose levels within range are considered in adequate control and are candidates for outpatient cervical ripening, if they have no obstetric contraindications. (See Outpatient cervical ripening guideline)

V. Management - Class A-2, pre-gestational, Overt DM diagnosed during this pregnancy, or Class B and above

A. Classification

-Patients with an abnormal OGTT should receive a 2-week trial of medical nutrition therapy (MNT).
If after a trial of MNT, FBS ≥ 95 mg/dL or 2 hour PPBS ≥ 120 mg/dL, if > 50% of the glucose levels are out of range, then the GDM patient is considered **Class A-2** and their care should be discussed with an Ob/Gyn about possible insulin or hypoglycemic therapy.

-Patients with pre-existing diabetes should be classified by Type I and Type II.
These patients need euglycemia, so > 90% glucoses in range is considered adequate control.

This classification can be supplemented with the White Classification. See Appendix B.

Obtain MFM consult for pre-existing Type I and Type II. DM

B. The patient should be discussed with an OB/GYN prior to initiating insulin therapy. Following are the objectives to be met at the time of starting insulin.

1. Education on the need for adequate control;

2. Diet education. See previous discussion of Medical Nutrition Therapy (MNT)

3. Learning to administer insulin and recognize signs and symptoms of hypoglycemia;

4. Reviewing home glucose monitoring by finger-stick;

5. Baseline physical assessment relating to diabetes in pre-gestational and above, especially:

   a. creatinine clearance and 24 hour urine protein
   b. ophthalmologic exam (If pre-existing or overt DM diagnosed in pregnancy)
   c. Serum Creat and BUN

6. If not yet done, ultrasound assessment of dates, fetal anatomy, and possible polyhydraminos.

C. Hypoglycemic Therapy

The goal is euglycemia. See previous glucose goals

Insulin

1. Human and DNA Recombinant Origin Insulin should be used.

2. Split doses of short and intermediate fasting insulin should be given twice daily; two-thirds of the day's insulin is given before breakfast and one-third prior to supper. Each dose can be divided two-thirds intermediate and one-third short acting insulin.

   A common approach is to start with the following doses, based on actual body weight

First trimester	0.8Units/ kg
Second trimester	1.0 Units/ kg
Third trimester	1.2 Units/ kg

3. Another common formula for initiating therapy is:
   - 20u NPH and 10u Regular insulin 30 minutes before breakfast, or Lispro insulin immediately before breakfast
   - 5-10u Regular 30 minutes before, or Lispro immediately before meals,
   - 7u NPH at supper.
   - Another helpful approach is to administer the NPH insulin at 9-10 pm to decrease fasting glucose.
   - Doses should be increased prn to keep glucose < 95 mg/dL fasting and < 120 mg/dL 2 hours post prandial

4. The patient should monitor her own blood glucose with chemstrips with a portable glucometer. See glucose goals above. This regimen may be liberalized if stable as an outpatient. The patient should maintain a flow sheet.

5. While tight control is the objective, hypoglycemia is a significant risk. If the patient has been admitted to initiate insulin, many feel it is best to discharge the patient as her control approaches but falls short of ideal. Fine tuning is then done on an outpatient basis under conditions of diet and exercise more normal for the patient.

6. Diet composition is the same as for Class A-1 but calories need to be spread among three meals and three or four snacks.

7. Long-acting insulin analogs (insulin glargine, insulin detemir) have not been

studied extensively in pregnancy at this writing.
Based on available data, we prefer use of human NPH insulin as part of a multiple injection regimen in pregnant women. There are good data supporting the safety and effectiveness of NPH in pregnancy and doses can be adjusted frequently and quickly in response to changing requirements in pregnant women.

Oral hypoglycemics

Glyburide has been used as an oral hypoglycemic in the 2nd and 3rd trimesters of pregnancy successfully in one randomized controlled trial. ACOG states that further study is recommended before the newer oral hypoglycemic can be supported for use in pregnancy. Oral hypoglycemics are being used onsite at ANMC in a monitored manner. The patient should be notified that while in common usage, oral hypoglycemics are not FDA approved for this particular use.

A. Glyburide
Start at 2.5 mg daily while monitoring glucose and diet
May be increased to 10 mg bid while monitoring glucose and diet
Can be combined or replaced with insulin therapy if outside desired clinical parameters.

B. Metformin
Start at 250-500 mg daily while monitoring glucose and diet
(Please start low and increase slowly to avoid gi side effects)
May be increased to 1000 mg bid slowly while monitoring glucose and diet
Can be combined or replaced with insulin therapy if outside desired clinical parameters.

D. Indications for admission:

1. The patient should be admitted for evaluation and control if any of the following conditions are noted:

   a. poor adherence or persistent hyperglycemia;
   b. pyelonephritis or severe infection;
   c. ketoacidosis;
   d. hypertension or pre-eclampsia.

E. Clinical Management

The insulin treated patient should be followed according to these guidelines:

1. Frequency of visits

   a. as often as daily until glycemic control as outpatient established;
   b. at least every month until 36 weeks, unless glucose control is inadequate, then q wk;
   c. weekly after 36 weeks.
   d. These visit intervals can be lengthened with good phone follow-up

2. Labs each visit

   a. the home flow sheet should be reviewed and a lab-done glucose obtained to verify control. This may be liberalized if village conditions warrant

3. Periodic lab work

a. PAPP-A and NT should be offered at 11-14 weeks, or quad testing should be offered at 15-20 weeks.
b. Fetal echocardiogram at 18-24 weeks
(If pre-existing or overt DM diagnosed in pregnancy)

4. US to be repeated q 4-6 weeks to monitor fetal growth

5. Fetal well-being assessment

a. If adequate control, e. g.,
(Adequate control > 50% glucose levels within range: GDM A2)
(Adequate control > 90% glucose levels within range: pre-existing DM)

then…daily fetal movement count 32-36 weeks
then…after 36 weeks - electronic and US assessment (below)
b. If less than adequate control, or as a default….
then….
-NST twice weekly starting at 32 weeks
-AFI once weekly starting at 32 weeks

6. Delivery

Delivery recommendations need to be tailored to diabetic class on a case by case basis
a. Deliver in the 39th week
Adequately controlled Class A2 and DM patients are eligible for outpatient cervical ripening. if they have no obstetric contraindications
-if good early dating
-amniocentesis not necessary, if good dating
(Adequate control > 50% glucose levels within range: GDM A2)
(Adequate control > 90% glucose levels within range: pre-existing DM)

b. Delivery in the 38th week
-if the above factors are not present, e. g., less than optimal glucose control, polyhydramnios, non-adherence with recommendations, clinical judgment based on obstetric contraindications
-if good early dating
-amniocentesis not necessary, if good dating
(Adequate control > 50% glucose levels within range: GDM A2)
(Adequate control > 90% glucose levels within range: pre-existing DM)

c. For women with DM in pregnancy and an estimated fetal weight of 4,500 g or more, cesarean delivery may be considered

7. Intrapartum Insulin

The goal of intrapartum insulin therapy is maternal and fetal euglycemia with a maternal glucose 60-90 mg/dL.

If patient is in active labor, then a mainline of D5LR @ 125 cc/hr should be maintained.

If the patient is in adequate glucose control, then on morning of induction patient should arrive NPO, having <u>not</u> taken her usual a.m. insulin dose. Obtain blood glucose q 1 hour in labor. The goal is to maintain glucose 60 –90 mg/dL to decrease neonatal hypoglycemia.

If the patient is in inadequate glucose control, or if the patient is scheduled for a morning cesarean delivery, then consider having the patient present the evening before the intervention for the following insulin drip.

Mix 250 units regular insulin in 250cc normal saline. (1u / 1cc)

Initial glucose	Bolus	Insulin Drip
< 65 mg/dL	-----	0.5 unit insulin / hr
65-99 mg/dL	-----	1 unit insulin / hr
100-124 mg/L	2 unit	1 unit insulin /hr
125-150 mg/dL	3 unit	1 unit insulin hr
> 150 mg/dL	4 units	2 units insulin / hr

Adjust drip to keep glucose between 60 – 90 mg/dL

Flow chart hourly BG
After initial phase above, don't re-bolus, just adjust drip within the following algorithm

Hourly Result	Rate
BG > 90	Increase by 1 unit / hr
BG 61-90	No change
BG 51 – 60	Decrease by 1 unit / hr
BG <51	Stop infusion & administer 50 ml D50W Contact provider Recheck BG after 15 minutes

NB: Remember 1 unit = 1 ml

VI. Postpartum Management

1. Obtain at least one fasting blood sugar prior to discharge for patients with Class A2 and above

2. The pre-gestational DM patient may undergo a transient 'honeymoon' period with euglycemia soon after delivery. The patient should be monitored closely prior to discharge and at home for impending hyperglycemia. The patient needs to be thoroughly evaluated for her insulin requirements at her 6-week postpartum check-up.

3. Nutrition consult.

4. The patient should be encouraged to maintain the exercise or dietary habits learned during pregnancy. The long-term goal should be to maintain her ideal body weight. A significant percentage, e.g., 70%, of GDM patients will become overtly diabetic, especially if > BMI 27.

5. Glucose tolerance should be re-evaluated at the six-week postpartum check-up and at a minimum of every 3 years thereafter.

   Please note that the HgbA1C should not be used till at least 12 weeks postpartum

6. Pre-diabetes: Both Impaired Fasting Glucose (IFG) and Impaired Glucose Tolerance (IGT) should re-tested yearly and treated with MNT and exercise because of their high risk of developing Type II diabetes.

7. The more sensitive test is a 75 gm 2 hour OGTT, but a fasting glucose can be diagnostic if elevated on two occasions
   The OGTT test requires the use of a glucose load containing the equivalent of 75 gm anhydrous glucose dissolved in water

8. The patient may also be diagnosed with classic symptoms of DM and a casual (random) glucose $\geq$ 200 mg/dL.

9. Outside of pregnancy the laboratory criteria for diabetes mellitus and pre-diabetes are:

Normal	**"Pre-diabetes" Impaired Fasting Glucose (IFG) or Impaired Glucose Tolerance IGT)**	**Diabetes mellitus***
FPG < 100 mg/dL	FPG 100 -125mg/dL	FPG $\geq$ 126 mg/ dL
2-h PG < 140 mg/dL	2-h PG 140-199 mg/dL	2-h PG $\geq$ 200 mg/dL
Hgb A1C	5.7- 6.4%	$\geq$ 6.5 %

*A diagnosis of diabetes must be confirmed on a subsequent day by any of the methods.
* DM also can be diagnosed by symptoms of DM and casual plasma glucose concentration ≥200 mg/dl

Strategy: To recap – Diagnosis of diabetes mellitus

1. **Hgb A1C ≥6.5% after 12 weeks**
The test should be performed in a laboratory using a method that is NGSP certified and standardized to the DCCT assay.*
OR
2. **FPG ≥126 mg/dl after 6 weeks**
Fasting is defined as no caloric intake for at least 8 h.*
OR
3. **2-h plasma glucose ≥200 mg/dl during an OGTT after 6 weeks**
The test should be performed as described by the World Health Organization, using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water.*
OR
4. In a patient with **classic symptoms** of hyperglycemia or hyperglycemic crisis, a random plasma glucose ≥200 mg/dl.

*In the absence of unequivocal hyperglycemia, criteria 1–3 should be confirmed by repeat testing

9. Postpartum 'increased risk of diabetes' Management
Individuals with prediabetes or increased risk for diabetes should be informed of their increased risk for diabetes as well as cardiovascular disease and counseled about effective strategies, such as weight loss and physical activity, to lower their risks.

As with glucose measurements, the continuum of risk is curvilinear, so that as Hgb A1C rises, the risk of diabetes rises disproportionately. Accordingly, interventions should be most intensive and follow-up should be particularly vigilant for those considered to be at high risk and the presence of other risk factors, such as obesity and family history.

Strategy: To recap – Diagnosis of 'at risk' for diabetes mellitus

FPG:	100 mg/dl to 125 mg/dl	– Impaired fasting glucose (IFG)
2-h PG in the 75-g OGTT:	140 mg/dl to 199 mg/dl	– Impaired glucose tolerance (IGT)
Hgb A1C	5.7–6.4%	– Prediabetes

-Using a standardized Hgb A1C assay (see References below)

VII. Family Planning and Future Pregnancy Consideration:

1. All contraceptive modalities are appropriate for the diabetic woman.
   Caveats include:
   -risk of weight gain with injectable medroxyprogesterone acetate and
   -increased insulin requirements with combination oral contraceptives.

2. Family planning and six-week postpartum weight control, exercise, and diet considerations are the
   same as for Class A-1 and pre-gestational DM patients.

VIII. Preconception counseling

1.) Weight loss and tight glycemic control should be in effect before conception of the next pregnancy. The teratrogenic effects of diabetes usually occur before the pregnancy is diagnosed.
Euglycemia can prevent these effects.

2.) Pre-existing diabetic preconception goals

Before meals (capillary blood glucose)	70 - 100 mg/dL
2 hours after meals "	< 140 mg/dL
Hgb A1C	within lab normal range

3.) The GDM patient may prevent diabetes with her next pregnancy by achieving her ideal body weight prior to conception.

4.) Folic acid supplementation is particularly important for diabetic women who already at increased risk of malformations.
-Patients with <u>no previous</u> offspring with neural tube defects should take 0.4 – 0.8 mg / day (1 mg might be easier) beginning at least 1 month prior to conception and continuing through the first trimester, to reduce the risk of neural tube defects
-Those with a previous infant with neural tube defects should take 4 mg.

IX. Care of the Newborn and child:

1. Hypoglycemia is the major risk.
2. Early initiation of breast feeding / enteral milk (within 30-60 minutes of birth)
3. Maintenance of neutral thermal environment to minimize unnecessary energy expenditure
4. Putting the infant to breast at the earliest sign of hunger (note: crying is a late hunger cue)
5. See the ANMC Pediatric Department Hypoglycemia guidelines (Appendix D)
6. Enter “infant of diabetic pregnancy” on baby’s problem list.
7. The offspring of diabetic mothers are at increased risk for development of overweight or obesity, and glucose intolerance. The offspring should maintain their ideal body weight along appropriate growth curves and be followed for subsequent glucose intolerance on a periodic basis.

Revised 2/23/19njm
Revised 10/18/18njm
Revised 3/23/18njm
Revised 2/5/16njm
Revised 3/3/14njm
Revised 5/6/13 njm
Revised 4/6/11 njm
Revised 8/410 njm
Revised 9/1/04 njm
Revised 1/15/02 njm
Revised 11/1/94 njm
Written September 1989

References

Diagnostic criteria
Classification and Diagnosis of Diabetes American Diabetes Association Diabetes Care 2017 Jan; 40(Supplement 1): S11-S24. http://care.diabetesjournals.org/content/40/Supplement_1/S11.long

Gestational diabetes mellitus. ACOG Practice Bulletin No. 190. American College of Obstetricians and Gynecologists. Obstet Gynecol 2018;131:e49–64.

HAPO Study Cooperative Research Group. Hyperglycemia and adverse pregnancy outcomes. N Engl J Med. 2008 May 8;358(19):1991-2002.
http://www.ncbi.nlm.nih.gov/pubmed/18463375

International Association of Diabetes and Pregnancy Study Groups Consensus Panel. International association of diabetes and pregnancy study groups recommendations on the diagnosis and classification of hyperglycemia in pregnancy. Diabetes Care. 2010 Mar;33(3):676-82.

Coustan DR et al The Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study: paving the way for new diagnostic criteria for gestational diabetes mellitus. Am J Obstet Gynecol. 2010 Jun;202(6):654.e1-6.

National Glycohemoglobin Standardization Program certified methods for A1c testing*
This website has a list of currently certified methods. http://www.ngsp.org/prog/index3.html

Does treatment of mild GDM improve outcomes?
Crowther CA, et al Effect of treatment of gestational diabetes mellitus on pregnancy outcomes. N Engl J Med. 2005 Jun 16;352(24):2477-86. Epub 2005 Jun 12.

Landon MB, et al. A multicenter, randomized trial of treatment for mild gestational diabetes. N Engl J Med. 2009 Oct 1;361(14):1339-48.

Alwan N, Tuffnell DJ, West J. Treatments for gestational diabetes. Cochrane Database of Systematic Reviews 2009, Issue 3. Art. No.: CD003395. DOI: 10.1002/14651858.CD003395.pub2.

ACOG
Pregestational diabetes mellitus. ACOG Practice Bulletin No. 60. American College of Obstetricians and Gynecologists. Obstet Gynecol 2005;105:675–85. (Reaffirmed 2016)

Gestational diabetes mellitus. ACOG Practice Bulletin No. 190. American College of Obstetricians and Gynecologists. Obstet Gynecol 2018;131:e49–64.

Shoulder dystocia. Practice Bulletin No. 178. American College of Obstetricians and Gynecologists. Obstet Gynecol 2017;129:e123–33.

Fetal growth restriction. Practice Bulletin No. 134. American College of Obstetricians and Gynecologists. Obstet Gynecol 2013;121:1122–33. (Reaffirmed 2018)

Metabolic Control for Elevated Abdominal Circumference
Hadlock FP et al. Estimating fetal age: computer-assisted analysis of multiple fetal growth parameters. Radiology 1984, 152:497-501.

Callen PW (ed): Ultrasonography in Obstetrics and Gynecology, 3rd ed, Philadelphia, WB Saunders, 1994.

Buchanan TA et al Use of fetal ultrasound to select metabolic therapy for pregnancies complicated by mild gestational diabetes. Diabetes Care. 1994 Apr;17(4):275-83.

Bochner CJ et al. Early third-trimester ultrasound screening in gestational diabetes to determine the risk of macrosomia and labor dystocia at term. Am J Obstet Gynecol. 1987 Sep;157(3):703-8.

Rossi G, et al Adequate timing of fetal ultrasound to guide metabolic therapy in mild gestational diabetes mellitus. Results from a randomized study. Acta Obstet Gynecol Scand. 2000 Aug;79(8):649-54.

Bonomo M et al. Flexible treatment of gestational diabetes modulated on ultrasound evaluation of intrauterine growth: a controlled randomized clinical trial. Diabetes Metab. 2004 Jun;30(3):237-44.

Kjos SL et al A randomized controlled trial using glycemic plus fetal ultrasound parameters versus glycemic parameters to determine insulin therapy in gestational diabetes with fasting hyperglycemia. Diabetes Care. 2001 Nov;24(11):1904-10.

Other management issues

American Diabetes Association. Standards of medical care in diabetes—2014.Diabetes Care January 2014; 37 (Supplement 1) S14-80

Metzger BE, Buchanan TA, Coustan DR, de Leiva A, Dunger DB, Hadden DR, et al. Summary and recommendations of the Fifth International Workshop-Conference on Gestational Diabetes Mellitus [published erratum appears in Diabetes Care 2007;30:3154]. Diabetes Care 2007;30 (suppl 2):S251 60.

Boulvain M, Stan CM, Irion O. Elective delivery in diabetic pregnant women. Cochrane Database of Systematic Reviews. Published Online: 7 OCT 2009, Assessed as up-to-date: 5 JUL 2004. Art. No.: CD001997. DOI: 10.1002/14651858.CD001997.

Lawton C. Highlights of the 2003 Clinical Practice Guidelines for the prevention and management of diabetes in Canada. CANNT J. 2004 Jan-Mar;14(1):40-3.

American Indian / Alaska Native / First Nations References

Murphy NJ, Bulkow LR, Schraer CD, Lanier AP. Prevalence of diabetes mellitus in pregnancy among Yup'ik Eskimos, 1987-1988. Diabetes Care. 1993 Jan;16(1):315-7.
http://www.ncbi.nlm.nih.gov/pubmed/8422799

Murphy NJ, Bulkow LR, Schraer CD, Lanier AP. Prevalence of diabetes mellitus in pregnancy among Yup'ik Eskimos and Alaska Coastal Indians, 1987-1988. Arctic Med Res. 1991;Suppl:423-6.
http://www.ncbi.nlm.nih.gov/pubmed/1365178

Kim C, Newton KM, Knopp RH.Gestational diabetes and the incidence of type 2 diabetes: a systematic review. Diabetes Care 2002 Oct;25(10):1862-8 (Level III)
http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&list_uids=12351492&dopt=Abstract

Brennand EA, Dannenbaum D, Willows ND. Pregnancy outcomes of First Nations women in relation to pregravid weight and pregnancy weight gain. J Obstet Gynaecol Can. 2005 Oct;27(10):936-44.
http://www.ncbi.nlm.nih.gov/pubmed/16411008

Alternative Screening Methods

Bergus GR, Murphy NJ. Screening for gestational diabetes mellitus: Comparison of a glucose polymer and a glucose monomer test beverage. J Am Board Fam Pract 1992; 5:241-7. (Level II-1)
http://www.ncbi.nlm.nih.gov/pubmed/1580171?dopt=Abstract

Murphy NJ, Meyer BA, O'Kell RT, Hogard ME. Carbohydrate sources for gestational diabetes screening: A comparison. J Reprod Med 1994; 39:977-81. (Level I)
http://www.ncbi.nlm.nih.gov/pubmed/7884757?dopt=Abstract

Appendix A
Alternative Options for Screening

75 Gram Carbohydrate Test Breakfast

On the morning of the test, your breakfast must follow one of the four breakfast menus listed below exactly. The right amount of carbohydrate is needed for accurate test results. Take no more than half an hour to eat breakfast. Eat nothing more until the test is over, and do not take a nap.

Once you have had an initial fasting sample drawn, the blood samples must be drawn exactly one and two hours after you began to eat. Please note the time you started eating. Example: If you started eating breakfast at 8:00 am, then be at the clinic/lab at 8:45 am to have your blood drawn by 9:00 am for the one hour specimen and so forth for the 2 hour specimen. Choose one of the menus below:

75-Gram Breakfasts*

#1:	1 cup cold cereal	23-24g
	1 cup milk	12g
	1 medium (~7") banana	27g
	1/2 cup (4 oz.) orange or apple juice	13g
	Total	75-76g
#2:	2 slices toast or 1 whole English muffin	30g
	1 Tbsp. jam	13g
	1 6oz container light fruit yogurt	32-33g
	Total	75-76g
#3:	2 pilot crackers	36g
	1 Tbsp. peanut butter	3g
	1 Tbsp. honey	17g
	1/2 cup canned fruit** with light syrup	18-19g
		74-75g
#4:	3 cups (24 oz.) Tang	74g

* To all of the above you may add the following.
The following items may make the meal more interesting and while they add a little more protein, fat, and calories in the longer term, in the short term they don't add more glucose for the duration of this test

- 1 hard-boiled egg and/or
- 2 dried salmon strips and/or
- 1-2 tsp. butter or margarine and/or
- black coffee or tea (no sugar or milk)

** peaches, pears or fruit cocktail

If you are unable to eat the types or amounts of foods indicated, contact your WH-PCC clinic for help with substitutions.

Regional Center based Polycose screening

Give 75 g of Polycose solution. Polycose is the best tolerated, e.g., no nausea, bloating, or lightheadedness and most reproducible among the alternative methods tested.

Polycose can be prepared ahead of time in the Pharmacy in the following manner:
75 g of Polycose, 75 mL of unsweetened club soda, and 1.5 gm of unsweetened lemon-lime Kool-Aid mix.

Village clinic based screening
A variety of methods are being tried. The most accurate, is to send a 75 g glucola drink to the health aide to be administered in clinic. A gray top tube is drawn fasting and at 1 hour and 2 hours. The plasma is separated off within 2-3 hours, refrigerated, and sent in.

Other options include:
Have the health aide obtain a capillary random glucose value by using a portable glucometer. If a value of 120 mg/dL or greater is found, then consult the referral physician.

Send a Standard 75 gram glucose drink to the health aide and have him/her administer it, followed by a 1 hour capillary glucose. If a value of 120 mg/dL or greater is found, then consult the referral physician.

Have the health aide give a simulated glucola drink, made by dissolving four tablespoons table sugar in eight ounces of water. Flavor with some lemon juice, if possible. Follow with a 1 hour glucose determination. If a value of 120 mg/dL or greater is found, then consult the referral physician.

Please note: sucrose is metabolized differently than glucose. The mixed meal methods are better than nothing, but sending out a glucola bottle or using Polycose is far superior.

Appendix B
Diabetes Predating Pregnancy White Classification

Class	Age of Onset (year)		Duration (year)	Vascular Disease	Therapy
A	Any		Any	0	
A-1, A-2,	Diet only Insulin (or oral hypoglycemics)				
B	> 20		< 10	0	Insulin
C	10-19	or	10-19	0	Insulin
D	< 10	or	> 20	Benign retinopathy	Insulin
F	Any		Any	Nephropathy	Insulin
R	Any		Any	Proliferative retinopathy	Insulin
H	Any Insulin		Any	Heart Disease	

Appendix C
BMI table here
http://www.nhlbi.nih.gov/guidelines/obesity/BMI/bmicalc.htm

Appendix D
ANMC Pediatric Department Hypoglycemia Guidelines

NEONATAL HYPOGLYCEMIA: GUIDELINES FOR PRACTICE

PURPOSE:

Hypoglycemia is a serious and significant risk to the neonate. Because the neonatal brain is glucose dependent, a lack of circulating glucose can cause neuronal damage. Implementation of these recommended interventions to prevent or treat hypoglycemia will support and facilitate a neonate's adaptation to extrauterine life. Infants who maintain adequate glucose homeostasis will:

- exhibit limited fluctuations in glucose levels
- demonstrate fewer signs and symptoms of hypoglycemia and have an absence of seizure activity and/or brain damage related to hypoglycemia events, and
- exhibit adequate growth and weight gain.

DEFINITION:

In general, any infant with a plasma glucose concentration of <40mg/dl warrants careful observation and should be considered hypoglycemic. Thus, therapeutic intervention is indicated. Infants who exhibit signs and symptoms of hypoglycemia that are relieved by the administration of glucose should be considered hypoglycemic, whatever the plasma glucose value.

PHYSICIANS WILL BE NOTIFIED IMMEDIATELY OF ANY INFANT THAT MEETS THIS DEFINITION

1. Signs and symptoms of neonatal hypoglycemia are variable and nonspecific, but may include the following:

A. Neurologic
   - tremors
   - jitters
   - hypotonia
   - irritability
   - lethargy
   - seizures
   - abnormal eye movements

B. Cardiorespiratory
   - cyanosis
   - pallor
   - tachypnea
   - periodic breathing
   - apnea
   - cardiac arrest

C. Other
   - abnormal or high pitched cry
   - hypothermia
   - diaphoresis

2. Relating or influencing factors that may result in hypoglycemia include
   A. Decreased substrate (glycogen) availability secondary to:
      - prematurity
      - intrauterine growth retardation (IUGR) or SGA
      - glycogen storage disease
      - inborn errors of metabolism (i.e. galactosemia)

   B. Endocrine disturbances causing hyperinsulinemia secondary to:
      - IDM
      - Beckwith-Wiedemann syndrome
      - erthroblastosis fetalis due to Rh incompatibility
      - islet cell dysplasia, nesidioblastosis
      - maternal drugs (i.e. beta-sympathomimetics, beta blockers, oral hypoglycemic drugs)

   C. Endocrine disorders such as:
      - hypopituitarism
      - hypothyroidism
      - adrenal insufficiency

   D. Increased utilization of glucose secondary to:
      - perinatal asphyxia
      - hypothermia

   E. Other causes such as:
      - sepsis
      - congenital heart disease
      - central nervous system abnormalities
      - exchange transfusion
      - infiltrated IV catheter

3. Blood glucose measurement
   A. Whole blood glucose concentrations are approximately 15% lower than plasma glucose concentration. The higher the hematocrit, the greater the difference between the whole blood and the plasma values.
   B. Glucose concentration may fall as much as 18 mg/dl/hour when allowed to remain unanalyzed at room temperature.
   C. The infant's heel should be warmed prior to drawing capillary samples, as venous stasis may cause an underestimation of the actual blood glucose value.

D. Glucose reagent strips should be used primarily as a screening method. Laboratory confirmation or serum glucose values should be performed when test strip values are abnormal or suspicious. Because of the significant risk to the patient if treatment is delayed interventions should be initiated if hypoglycemia is suspected by test strip or clinical symptoms, even if the laboratory confirmation is not available.

4. Suggested interventions/prophylactic care of any infant assessed to be at risk for hypoglycemia includes:
   A. Early milk/formula feeding, if appropriate, or IV infusion of D10W.
   B. Maintenance of a neutral thermal environment, particularly in low birth weight infants, to minimize unnecessary energy expenditure.
   C. Correction or treatment of other problems that may increase energy requirement.

References:

Haney, Peter M. 2006. *Neonatal hypoglycemia in UpToDate.*
Gomella, Tricia L. 2004. *Neonatology, 5th ed.* McGraw Hill, 262-266.
Cloherty, John P. and Stark, Ann R. 1998. *Manual of Neonatal Care, 5th ed.* Lippincott-Raven, 545-550.
Merenstein, Gerald B. and Gardner, Sandra L. 1998. *Handbook of Neonatal Intensive Care, 5th ed.* Mosby, 259-273.
Neonatal Hypoglycemia Guidelines for Practice. National Association of Neonatal Nurses, 1994.

Written: 3/ 98
Revised: 4/99; 4/01, 11/07
Reviewed: 7/07, 2/09

Appendix E
Gestational Diabetes Traditional Foods Meal Plan with Milk

Gestational Diabetes Meal Plan with Milk

Your food plan shows different food groups as well as how to eat from each food group. One sample food plan is shown. It contains about 2000-2,200 calories.

Servings	Example	Portions
Breakfast		
1 starch	Whole wheat toast	1 slice
1 meat	Moose/Caribou/fish or egg	2 ounces or 1 egg
1 fat	Margarine	1 teaspoon
1 milk	Skim milk (or 2%)	1 cup (8 ounces)
Snack		
1 fruit	Small Banana or canned fruit (in it' own juice)	1 or 1/2 cup (4 ounces)
Lunch		
2 starch	Whole wheat bread	2 slices
1 meat	Fish	2 ounces
1 fruit	Berries alone or with sugar substitute	1 cup (8 ounces)
2 veg.	Wild greens or canned/frozen veg	1 cup (8 ounces)
1 milk	Skim milk (or 2%)	1 cup (8 ounces)
1 fat	Mayonnaise	2 teaspoons
Snack		
1 starch	Pilot bread	1/2 piece
1/2 meat	Peanut butter	1 tablespoon
1 fruit	Small Orange/Apple or canned fruit	1 piece or 1/2 cup canned
Dinner		
3 starch (1)	Whole wheat bread	1 slice
(2)	Rice	2/3 cup
1 meat	Bird (Ptarmigan, chicken, goose…)	3 ounces
2 veg	Broccoli or other veg	1 cup
1 milk	Skim milk (or 2%)	1 cup (8 ounces)
Snack		
1 milk	Low sugar yogurt	1 cup (8 ounces)

Appendix F
Exercise guidelines to improve glucose control

Type of activities:
- Aerobic activities such as walking, stationary cycling, or swimming

Frequency:
- At least 3 days per week

Duration:
- 20-45 minutes per session

Intensity:
- Moderate. The "talk-sing test" may be used – the patient should be able to talk while exercising; if she can sing, the pace can be increased. If using rating of perceived exertion (RPE) exertion level should feel "fairly light" to "somewhat hard".
- Patient should warm-up before and cool down after exercise, drink plenty of water, and have snacks nearby if needed.

Initial exercise consult:
- Assessment of current physical activities and level of readiness for exercise
- Education/Information on exercise and GDM
- Individualized exercise plan

Supervised exercise:
- Measure blood glucose pre and post exercise
- Exercise on treadmill and/or recumbent cycle
- Monitor perceived exertion
- Monitor blood pressure and/or heart rate as needed

Appendix G
Percentile values for fetal abdominal circumference

From
Callen PW (ed): Ultrasonography in Obstetrics and Gynecology, 3rd ed, Philadelphia, WB Saunders, 1994, based on Hadlock FP et al. Estimating fetal age: computer-assisted analysis of multiple fetal growth parameters. Radiology 1984, 152:497-501.

Table 11-5 Percentile values for fetal abdominal circumference

Menstrual Week	Abdominal Circumference (cm)				
	3rd	10th	50th	90th	97th
14	6.4	6.7	7.3	7.9	8.3
15	7.5	7.9	8.6	9.3	9.7
16	8.6	9.1	9.9	10.7	11.2
17	9.7	10.3	11.2	12.1	12.7
18	10.9	11.5	12.5	13.5	14.1
19	11.9	12.6	13.7	14.8	15.5
20	13.1	13.8	15.0	16.3	17.0
21	14.1	14.9	16.2	17.6	18.3
22	15.1	16.0	17.4	18.8	19.7
23	16.1	17.0	18.5	20.0	20.9
24	17.1	18.1	19.7	21.3	22.3
25	18.1	19.1	20.8	22.5	23.5
26	19.1	20.1	21.9	23.7	24.8
27	20.0	21.1	23.0	24.9	26.0
28	20.9	22.0	24.0	26.0	27.1
29	21.8	23.0	25.1	27.2	28.4
30	22.7	23.9	26.1	28.3	29.5
31	23.6	24.9	27.1	29.4	30.6
32	24.5	25.8	28.1	30.4	31.8
33	25.3	26.7	29.1	31.5	32.9
34	26.1	27.5	30.0	32.5	33.9
35	26.9	28.3	30.9	33.5	34.9
36	27.7	29.2	31.8	34.4	35.9
37	28.5	30.0	32.7	35.4	37.0
38	29.2	30.8	33.6	36.4	38.0
39	29.9	31.6	34.4	37.3	38.9
40	30.7	32.4	35.3	38.2	39.9

From Callen PW (ed): Ultrasonography in Obstetrics and Gynecology, 3rd ed. Philadelphia, WB Saunders, 1994. Modified from Hadlock FP, Deter RL, Harrist RB, Park SK: Estimating fetal age: computer-assisted analysis of multiple fetal growth parameters. Radiology 1984;152:497-501.

References

1. Campbell S, Wilkin D: Ultrasonic measurement of fetal abdominal circumference in the estimation of fetal weight. Br J Obstet Gynaecol 1975;82:689-697.
2. Hadlock FP, Deter RL, Harrist RB, et al: Fetal abdominal circumference as a predictor of menstrual age. Am J Roentgenol 1982;139:367-370.
3. Tamura RK, Sabbagha RE: Percentile ranks of sonar fetal abdominal circumference measurement. Am J Obstet Gynecol 1980;138:475-479.
4. Hoffbauer H, Arabin PB, Baumann ML: Control of fetal development with multiple ultrasonic body measures. Contrib Gynecol Obstet 1979;6:147-156.
5. Chitty LS, Altman DG, Henderson A, et al: Charts of fetal size: 3. Abdominal measurements. Br J Obstet Gynaecol 1994;101: 125-131.
6. Gardosi J, Mongelli M, Wilcox M, et al: An adjustable fetal weight standard. Ultrasound Obstet Gynecol 1995;6:168-174.
7. Callen PW (ed): Ultrasonography in Obstetrics and Gynecology, 3rd ed. Philadelphia, WB Saunders, 1994. Modified from Hadlock FP, Deter RL, Harrist RB, et al: Fetal abdominal circumference as a predictor of menstrual age. Am J Roentgenol 1982;139: 367-370.