

Insulin Pump Therapy

TEXAS
Department of
State Health ServicesTEXAS DIABETES
COUNCIL

Introduction

The goal of insulin delivery is to regulate blood glucose levels to achieve normoglycemia. In someone without diabetes, pancreatic B-cells continuously secrete insulin throughout the day and night, providing a continuous insulin infusion or basal amount. In response to meals, the pancreas provides “bursts” of insulin referred to as boluses.

Pump therapy is intended to more closely mimic this pancreatic function. Continuous subcutaneous insulin infusion (CSII) utilizes only fast acting insulins (Humalog, Novolog) and eliminates the use of long-acting insulins (NPH, Ultralente, Lantus). Pumps can deliver insulin in 0.1 unit increments as a basal/continuous flow between meals and through the night. Basal rates can be increased or decreased at any point, allowing for exercise, illness, skipped meals, sensitivity to insulin and the dawn phenomenon. Boluses of insulin can be delivered via the pump to provide insulin to compensate for carbohydrate intake and hyperglycemic episodes when needed.

Insulin pump therapy gives people with diabetes the freedom to enjoy life, despite their chronic condition. The value of an improved lifestyle, increased flexibility and optimal diabetes control is obvious from the impact the insulin pump has made in the twenty-five years since its inception.

The ability to control how and when insulin is delivered provides the “pumper” with increased flexibility in scheduling their day-to-day activities. For those people with erratic lifestyles, a desire to achieve optimal glycemic control ($A1c \leq 6.5\%$) and prevent chronic complications, the pump is an ideal choice.

INDICATIONS FOR PUMP THERAPY

Clinical Indications

1. Inadequate glycemic control with MDI (Multiple Daily Injections) therapy
2. Recurrent severe hypoglycemia
3. Recurrent hyperglycemia
4. Hypoglycemia unawareness
5. Dawn phenomenon
6. Preconception
7. Pregnancy
8. Gastroparesis
9. Early neuropathy or nephropathy, when improvement in glucose control can reduce acceleration of complications
10. Renal transplantation

11. Frequent DKA
12. Uncontrolled diabetes
13. Erratic Blood Glucose
14. Prevent or delay complications
15. Desire to improve lifestyle flexibility
16. A1c greater than 6.5%

Lifestyle indications

1. Erratic schedule
2. Varied work shifts
3. Desire for improved flexibility
4. Inconvenience of multiple daily injections

Advantages of Pump Therapy

1. More flexible lifestyle
2. Improved overall control
3. Prevent chronic complications
4. Improved control during exercise and “growth spurts”
5. Tight control during pregnancy

Characteristics of Pump Candidates

Ready, willing, and able

1. Is motivated — pump therapy requires a strong desire to improve one’s health and is a time investment for weeks or months in advance and during the initiation of pump therapy.
2. Has realistic expectations — a potential pump candidate must understand that the pump will not “fix” blood glucose variations automatically, nor will it grant freedom from frequent SMBG (self monitoring of blood glucose).
3. Demonstrates independent diabetes management — a thorough knowledge of diabetes and its management and the ability to demonstrate appropriate self-care behaviors provide the foundation for advanced self-management skills required by pump users.
4. Is practicing counting carbohydrates — has a willingness to practice the Carbohydrate (CHO or carb) Counting method, and an understanding of insulin actions and pre-meal bolus dosing calculations.

5. Has manual dexterity — able to use buttons on the pump and has good visual acuity to see the screen.
6. Has a good support system — emotional support is crucial to the success of pump therapy.
7. Demonstrates emotional stability — a potential pumper must attend education sessions and attend to tasks that require routine attention. The patient must keep physician appointments.

Poor Candidates for Pump Therapy

1. Patients who are unwilling to comply with follow-up appointments.
2. Patients who are unwilling to receive diabetes education.
3. Patients who are unwilling to perform SMBG 8 times a day initially and then, 4-6 times a day after CSII therapy is established.
4. Patients who are unable or unwilling to count carbohydrates.

DETERMINING TOTAL DAILY DOSE AND BASAL RATE

Method #1:

Pre-pump Total Daily Dose (TDD)

Reduce pre-pump Total Daily Dose by 25%

Divide “pump” TDD in half: 50% for basal; 50% for bolus

Method #2:

Using Patients Weight Factor: Weight (lbs) X 0.1 = basal rate per hour

Start with 1 basal rate per 24 hours.

Based on blood glucose results during the times listed below, it may be necessary to implement additional basal rates based on patient’s blood glucose (BG)

12:00 midnight – 3:00 a.m.

3:00 a.m. – 7:00 a.m.

7:00 a.m. – 12:00 noon

12:00 noon – 6:00 p.m.

6:00 p.m. – 12:00 midnight

Time Frame For Beginning Pump Therapy

1. 1–2 months before pump start:

- ♦ Assess whether or not patient meets the criteria for a “pumper.”

- ♦ MD writes orders for insulin pump therapy. Contacts the insurance company for pre-authorization of coverage.
- ♦ Patient is seen by a CDE/dietitian for carbohydrate counting instruction.
- ♦ Patient is seen by the pump trainer for knowledge assessment and education as needed — to include: hypoglycemia, hyperglycemia and sick day management, prevention of DKA, patient's responsibilities, and general knowledge regarding diabetes.

2. 1-2 weeks before pump start:

- ♦ Patient watches video/DVD on use of the pump several times to familiarize him/herself with the pump.
- ♦ May attend “pump school” via the Internet if available.
- ♦ Meets with pump trainer for basal rates, boluses, insulin to carbohydrate ratio, and insulin correction factor if not already done.

3. Day before pump start:

- ♦ Discontinue use of long-acting insulin (NPH, Lantus, Ultralente).
- ♦ Continue injecting Novolog or Humalog before meals.
- ♦ Use “correction formula” to cover for “highs.”

4. Day of pump start:

- ♦ Eat breakfast and inject Humalog or Novolog as usual.
- ♦ Wear comfortable, loose-fitting clothing — preferably 2-piece outfit.
- ♦ Allow 3 hours for training.
- ♦ Bring supplies with you to include:
Pump, User's Manual, Infusion Sets — at least 2, Cartridges — at least 2, Skin Prep, Glucose Meter / Lancets / Strips, Alcohol Wipes, Insulin (Novolog or Humalog), Batteries, Carbohydrate Snack.

5. First Day of Pump Therapy:

- ♦ Begin “Four-Day Plan.”
- ♦ Call pump trainer with glucose levels and carbohydrate intake.

6. When “Four-Day Plan” completed:

- ♦ Come into office for first follow-up. Patients MUST bring: documentation of glucose readings, boluses (for elevated glucoses or meals), diary of carbohydrate Intake.
- ♦ Begin “Three-Day Plan.”

7. Within 1–2 days after completing “Three-Day Plan”

- ♦ Call pump trainer with readings.
- ♦ Adjust basals/boluses as needed.

8. Weekly for four weeks:

- ♦ Call pump trainer and report complete record.
- ♦ Adjust basals, insulin to carbohydrate ratios as needed.
- ♦ Instruct on added features of the pump, i.e., Dual and Square Wave Boluses, utilizing temporary basal rate, Easy Bolus, Audio Bolus.
- ♦ Adjust basal rates first, based on fasting glucoses. When fasting glucoses are at goal, adjust boluses and/or insulin to carbohydrate ratios to achieve pre- and post-meal glucose goals.

TESTING BASAL RATES: FOUR DAY PLAN

First Day

1. Eat supper by 7 p.m.
2. **Skip a bedtime snack.**
3. Test blood sugar every 2 hours between supper and bedtime; at 12:00 Midnight, and at 3:00 a.m.
4. Record your results!

Second Day

1. Eat breakfast.
2. **Skip lunch.**
3. Test blood sugar every 2 hours between breakfast and supper.
4. Record your results!

Third Day

1. **Skip breakfast.**
2. Test blood sugar every 2 hours between waking up until lunch.
3. **DO NOT SLEEP IN!**
4. Record your results!

Fourth Day

1. Skip supper.
2. Test blood sugar every 2 hours between lunch and your bedtime snack at 10:00 p.m.
3. Record your results!

NOTE: Do not “fix” a high blood sugar during the time you are checking every 2 hours. Correct at your next scheduled meal using your correction factor.

If you miss a day, continue the plan the next day. But try not to miss a day — the sooner the plan is completed, the sooner your basal rates will be set.

PRE-PUMP EDUCATION CHECKLIST

Patient Name _____ Date _____

Certified Pump Trainer _____

MD's Name _____

Pump Model _____ Serial # _____

UNDERSTANDING PUMP THERAPY <input type="checkbox"/> Theory <input type="checkbox"/> Meal Bolus <input type="checkbox"/> Insulin Type <input type="checkbox"/> Insulin Sensitivity/ <input type="checkbox"/> Basal Rate Correction Factor	NUTRITION <input type="checkbox"/> Carb. Counting <input type="checkbox"/> Using Food Labels <input type="checkbox"/> Insulin to Carb. Ratio <input type="checkbox"/> Proper Snacks
BLOOD GLUCOSE TESTING <input type="checkbox"/> Schedule <input type="checkbox"/> Alc	EXERCISE <input type="checkbox"/> Safety <input type="checkbox"/> Proper Snacks <input type="checkbox"/> Hypoglycemia <input type="checkbox"/> BG Checks
HYPOGLYCEMIA <input type="checkbox"/> Protocol/"Rule of Fifteen <input type="checkbox"/> Glucagon	PUMP THERAPY RESOURCES <input type="checkbox"/> User's Guide <input type="checkbox"/> Pump School Online <input type="checkbox"/> Websites
HYPERGLYCEMIA <input type="checkbox"/> Protocol <input type="checkbox"/> Ketone Testing	WHEN TO CALL YOUR DOCTOR
DKA <input type="checkbox"/> Causes <input type="checkbox"/> Signs and Symptoms <input type="checkbox"/> Prevention	WHEN TO CALL 24 HOUR HELP LINE
SICK DAY MANAGEMENT <input type="checkbox"/> Protocol <input type="checkbox"/> Supplies	

Notes:

DETERMINING BOLUSES

Calculating Insulin Sensitivity Factor (ISF)

Also may be referred to as the Insulin Correction Factor (ICF)

The Insulin Sensitivity Factor (ISF) is the amount of blood glucose reduced by 1 unit of rapid or short acting insulin over a 2–4 hour period. Two commonly accepted formulas are used to determine the ISF: the 1800 Rule and the 1500 Rule. Endocrinologist Paul C. Davidson, MD developed the 1500 Rule. With the introduction of rapid-acting insulin, John Walsh, PA CDE modified the 1500 Rule into the 1800 Rule. Generally, the 1800 Rule is used for patients who are insulin sensitive or those who use rapid-acting insulin and the 1500 Rule for patients who are insulin resistant or those who use short-acting insulin. The Rules calculate the ISF by dividing either 1800 or 1500 by the TDD.

$$\begin{array}{l} \text{Amount of Blood Glucose lowered by 1 unit of insulin (1800 Rule)} \\ \frac{1800 = \text{ISF}}{\text{TDD}} \end{array}$$

Note: 1800 currently used with Humalog or Novolog instead of 1500 (1500 Rule)

Calculating Insulin to Carb Ratio (ICR)

This method of determining the Insulin:Carbohydrate ratio is based on Total Daily Insulin Dose (TDD). The TDD is divided into 500 and the result is the amount of carbohydrate that one unit of rapid- or short-acting insulin will cover. The goal is to bring blood glucose levels into the target range 3–4 hours after the meal.

$$\begin{array}{l} \text{Grams of carbs covered by 1 unit of insulin (500 Rule)} \\ \frac{500 = \text{ICR}}{\text{TDD}} \end{array}$$

TYPES OF BOLUSES

Normal Bolus—total bolus infused at onset of meal

Square Wave—total bolus infused slowly over several hours; useful in cases of gastroparesis

Dual Wave—part of bolus is infused at onset of meal, and remainder is infused slowly over several hours; useful for high fat meal, i.e., pizza, Mexican food.

Adjusting/Fine Tuning Dosage

Empower patients to evaluate and adjust their BG. Resume intensive monitoring if necessary, i.e., 8 times a day. Start with overnight basals; promote low-fat, consistent carb content meals. Introduce high fat meals after ICR has been established or corrected. When high fat meals are consumed, consider utilizing **Dual Wave** bolus. Two-hour postprandial glucose goals should be 30 +/- points above preprandial BG. Patient may require a different ICR for each meal. BG targets should be determined by the provider and the patient and depending on age of the patient, concomitant

conditions and the patients' ability and willingness to achieve tight control of their diabetes.

POSSIBLE COMPLICATIONS OF PUMP THERAPY

Hypoglycemia — fewer episodes than with MDI. Possible improvement in hypoglycemic unawareness.

Diabetic Ketoacidosis — interruption in Humalog/Novolog delivery can lead to high BG and DKA in 4 +/- hours. Patient must check BG 4–6 times a day.

Skin Infections — meticulous skin care is necessary at infusion sites, which must be rotated every 2–3 days.

Weight Gain — could be a result of improved control or if patient liberalizes diet.

Initiation of CSII should be done by a Certified Pump Trainer (CPT) who is usually provided by the insulin pump manufacturer, or a Certified Diabetes Educator (CDE), who has received specialized training in insulin pump therapy. The various features of the pump should be demonstrated/ explained to the patient who should be provided with phone numbers of the insulin pump company and the provider. The patient should be encouraged to keep detailed records of BG, insulin dosage, carb intake, and other daily activities.

Table for Estimated Basal Rate and Insulin to Carbohydrate Ratio

WEIGHT IN POUNDS	BASAL INSULIN	CARBOHYDRATE RATIO
100	0.3 to 0.5	1 unit / 16 gms
110	0.3 to 0.5	1 unit / 15 gms
120	0.4 to 0.6	1 unit / 15 gms
130	0.4 to 0.6	1 unit / 14 gms
140	0.5 to 0.7	1 unit / 13 gms
150	0.5 to 0.7	1 unit / 12 gms
160	0.6 to 0.8	1 unit / 12 gms
170	0.6 to 0.8	1 unit / 11 gms
180	0.7 to 0.9	1 unit / 10 gms
190	0.8 to 1.0	1 unit / 9 gms
200	0.9 to 1.1	1 unit / 8 gms

Estimated Correction Factor

CURRENT TDD	CORRECTION FACTOR
10 units	150 points
20 units	75 points
25 units	60 points
30 units	50 points
40 units	38 points
50 units	30 points
60 units	25 points
75 units	20 points
100 units	15 points
150 units	10 points

Carbohydrate Counting

Carbohydrate counting is a meal planning approach that works well with insulin pump therapy. It is a great way to add variety and flexibility in choices of meals and snacks. Carbohydrate counting has been proven to help achieve better glucose control.

Generally carbohydrate is the main food group that increases blood sugar. Protein has a sustaining effect and fat slows absorption.

It is essential that the patient understands and practices the techniques of carbohydrate counting prior to pump initiation.

Many references such as the materials included in Chapter 5 of Diabetes Life Skills Book or the “Daily Meal Planning Guide” by Eli Lilly are used by the CDE or Registered Dietitian to teach Carbohydrate Counting.

Tools needed to count carbs:

1. Measuring cups
2. Food labels
3. Calculator
4. Carb counting book/guide

Carbohydrate containing foods include breads, pasta, rice, other grains, starchy vegetables (potatoes, corn, peas), crackers, cereals, fruit (fresh, canned, frozen, or juice), milk, yogurt & ice cream, cooked dried beans, cake, cookies, pie, sugar/honey.

One serving is considered 15 grams of carbohydrate and is contained in:

- 1/3 cup cooked rice, beans, or pasta
- 1/2 cup starchy vegetables like corn, peas, potato, or cooked cereal

1 slice bread or 1 tortilla

1 small piece of fruit, ½ small banana, or ½ cup light canned fruit

1 cup milk

Using measuring cups and reading labels are highly recommended as the patient practices at home.

THE RULE OF 500

This method of determining the Insulin:Carbohydrate ratio is based on Total Daily Insulin Dose (TDD). The TDD is divided into 500 and the result is the amount of carbohydrate that one unit of rapid- or short-acting insulin will cover. The goal is to bring blood glucose levels into the target range 3–4 hours after the meal.

Example:

TDD is 36 units

Glucose levels are within target range

$500/36 = 13.8$ (round up to 14 or 15)

Insulin to carbohydrate ratio is 1:15

1 unit of insulin covers 15 gm carbohydrate

Some CDEs find that dividing 450 (rather than 500) by the TDD is more accurate for short-acting insulin and/or for people who are more insulin resistant.

Insulin Sensitivity

The Insulin Sensitivity Factor (ISF) is the amount of blood glucose reduced by 1 unit of rapid or short acting insulin over a 2–4 hour period. Two commonly accepted formulas are used to determine the ISF: the 1800 Rule and the 1500 Rule. Endocrinologist Paul C. Davidson, MD developed the 1500 Rule. With the introduction of rapid-acting insulin, John Walsh, PA CDE modified the 1500 Rule into the 1800 Rule. Generally, the 1800 Rule is used for patients who are insulin sensitive or those who use rapid-acting insulin and the 1500 Rule for patients who are insulin resistant or those who use short-acting insulin. The Rules calculate the ISF by dividing either 1800 or 1500 by the TDD.

Example:

TDD is 34 units

$1800/34 = 52.9$

ISF is 52.9. One unit of rapid-acting insulin decreases glucose by 52.9 mg/dL

This can be rounded to 55

Another method of calculating the ISF is to use the general “safe” starting point of 1 unit: 50 mg/dL. This method may work well with most lean to average adults.

An alternative method for Insulin:Carb ratio can be figured once the person's ISF is calculated, multiplying it by 0.33 provides an insulin-to-carbohydrate ratio.

Example:

ISF is 55 mg/dL

$55 \times 0.33 = 18.15$ (round to 18)

Insulin to carb ratio is 1:18

1 unit of insulin covers 18 g of carbohydrate

Verifying Insulin:Carb Ratio and Insulin Sensitivity

Prior to eating, the bolus insulin dose is partially based on the insulin to carbohydrate ratio. This ratio tells how many grams of carbohydrate are affected by one unit of insulin. The ratios can be verified with one of the methods described below:

Method 1: Food diary, insulin dose, and SMBG information

The pump user is to keep 3 days of records, including:

1. Fasting, pre-meal, and 2-hour PPG results
2. Pre-meal insulin doses
3. Amount of carbohydrate consumed at meals and other times. It is helpful if the patient consumes the same amount of carbohydrate at each breakfast for 3 days, same amount of carbohydrate at each lunch for 3 days, etc.
4. Amount of all food and beverage consumed, as fat and protein moderately affect blood sugar.

With these records, determine the amount of insulin the patient used to cover the carbohydrate consumed at each meal by dividing the total grams of carbohydrate by the number of units of insulin.

Example:

Consumed 60 g carbohydrate

Injected (bolused) 5 u rapid-acting insulin

PPG is within 30 mg increase of pre-meal blood glucose

$60/5 = 12$

Insulin to carbohydrate ratio = 1:12

1 unit of insulin covers 12 g carbohydrate

CARBOHYDRATE COUNTING FOOD LOG

Write down all food or drink you consume for at least 3 days. Be sure to include portion sizes and the time you eat or drink. Estimate the amount of carbohydrates in each meal and snack; then record the amount of insulin you took. Bring this log with you on appointments to the pump trainer or the dietitian.

DATE/TIME	BLOOD SUGAR (2 HRS PP)	FOOD	GRAMS OF CARBS	INSULIN

DATE/TIME	BLOOD SUGAR (2 HRS PP)	FOOD	GRAMS OF CARBS	INSULIN

DATE/TIME	BLOOD SUGAR (2 HRS PP)	FOOD	GRAMS OF CARBS	INSULIN

Calculating Total Grams of Carbohydrate in a Recipe

To determine the amount of carbohydrates in a recipe:

1. Make a table as noted below
2. List ALL the ingredients in the recipe
3. Using food labels or a nutrient composition book, list the total grams of carbohydrate in each ingredient (amount of fat and sodium can also be calculated)
4. Total the grams of carbohydrate from all ingredients
5. Divide the total grams of carbohydrate by the number of servings in the recipe
6. Note the total grams of carbohydrate PER SERVING on the recipe for future reference

Recipe Name: _____

Ingredient	Amount	Grams of Carbohydrate	Grams of Fat

Example:

Corn Pudding (Makes 8 Servings)

Ingredient	Amount	Grams of Carbohydrate	Grams of Fat
Cornstarch	2 Tablespoons	14	0
Egg Substitute	½ cup	2	0
Sugar	½ cup	100	0
Creamed Corn	16 oz. can	60	0
Evaporated Skim Milk	16 oz. can	60	0
TOTAL		236	0
Divide total carbohydrate by number of servings (236/8)		45	

This recipe has 29.5 grams of carbohydrate and zero (0) grams of fat per serving.

IDENTIFYING AND MANAGING HYPERGLYCEMIA

Sick Day Management (Refer to “Sick Day Guidelines” in TDC Tool Kit)

During periods of illness, it may be more difficult to maintain good control of blood glucose. Examples of illness or “sick days” include: dental surgery, colds, sore throat, mild infections, nausea, vomiting, diarrhea, or fever. It is important to monitor blood glucose more frequently during a sick day and to take immediate action to prevent ketoacidosis.

Guidelines to follow:

Medication

Never omit insulin. Even if unable to eat, insulin need continues and may increase.

Continue the basal dose of insulin and make additional corrections using the Correction/Sensitivity Factor as needed. Urine ketone testing can further guide the correction doses.

Blood/Urine Testing

Check blood glucose before usual mealtimes and every 2 to 4 hours, keeping a written record of results.

Check urine for ketones if blood glucose is greater than 250 mg/dL or as directed by the physician.

Fluids/M meal Planning

Consuming adequate fluids is important during illness. Drink fluids every hour while awake and during blood glucose checks at night.

If able to eat, drink non-caloric beverages.

If unable to eat, alternate non-caloric beverages with those containing carbohydrate.

Consume 10–15 grams of carbohydrate every 1–2 hours.

Severe high blood glucose and ketoacidosis (DKA) are serious medical problems that sometimes occur in diabetes. High blood glucose can exist for some time without triggering ketoacidosis. Ketoacidosis begins only after insulin levels in the body go very low. When insulin is low, glucose cannot be used as fuel. Glucose is the body’s first choice for energy, but if not available due to inadequate insulin levels, the body must start burning fat even though glucose is high in the blood. Ketones are the by-product of burning fat for energy and in high levels, cause nausea and vomiting. Vomiting, in combination with high blood sugars, can lead to dehydration.

Ketoacidosis can be triggered by:

1. Illness
2. Infections
3. Pump Malfunction
 - Loose Luer-lock connection

- Dislodged infusion set
- Site irritation or overuse
- Empty pump reservoir/cartridge
- Expired insulin
- Incorrect bolus calculation
- Missed bolus doses
- Inadequately programmed basal rates

A pump user needs to take a correction dosage using a syringe if spilling moderate to large ketones, then change the infusion set. Plenty of water should be consumed to help flush ketones from the body.

Call a physician for further instruction.

IDENTIFYING AND MANAGING HYPOGLYCEMIA

Causes:

Glucose levels can drop to dangerously low levels if there is not a balance between food, medication, and activity. It can occur very quickly and without warning. Not eating properly, delaying or skipping meals, an error in medication dose, or engaging in exercise that is too difficult or too strenuous are all causes of hypoglycemia.

Signs and Symptoms:

Shaking	Sweating
Weakness	Anxiety
Headache	Blurred vision
Dizziness	Fast heartbeat
Irritability	Fatigue

“Rule of 15”

1. Immediately stop activity and check glucose levels. If driving, immediately pull off the road
2. If no glucose meter is available, treat regardless
3. Consume 15 gms of a fast-acting carbohydrate
 - ½ cup juice
 - 5 sugar cubes
 - 4 glucose tablets
 - 6–7 lifesavers
 - ½ cup regular soda
 - 8 oz. skim milk
 - 2 tsp. sugar
 - 8–9 jellybeans
 - 1 tube glucose gel

4. Rest for 15–20 minutes
5. Retest glucose — if still below 70 mg/dl, repeat fast-acting carbohydrate. Or if no glucose meter is available, and symptoms are still present, repeat fast-acting carbohydrate
6. Continue steps 1 – 5 until glucose level is above 70 mg/dl
7. An extra snack consisting of a carbohydrate and protein may be needed if more than one treatment was required and no meal will be eaten within a half-hour. Examples are:
 - ½ sandwich
 - Cheese and crackers
 - Peanut butter and crackers
8. If several hypoglycemic episodes occur at the same time over a few days, the basal rate will need to be adjusted; notify the pump trainer immediately
9. ALWAYS carry a fast-acting carbohydrate in a place that is easily accessible
10. ALWAYS wear identification stating that you have diabetes and are being treated with an insulin pump

APPENDIX

PHYSICIAN'S ORDERS FOR INSULIN PUMP START

Patient Name _____ Date _____

Certified Pump Trainer _____

These orders expire on _____

Basal rates may be adjusted by 0.05 increments for BG above _____ and/or _____ below.

Starting Basal Rate:

Profile	Time	Units per Hour
#1	12:00 a.m.	_____

Starting Bolus Doses

Insulin to Carbohydrate Ratio: 1 unit per _____ gms. carbohydrate

Insulin Sensitivity Ratio
(Correction Factor): 1 unit of insulin will lower BG by _____ mg/dl

Target Blood Glucose Levels

3:00 A.M. _____ to _____

Fasting. _____ to _____

Before meals. _____ to _____

After meals. _____ to _____

Additional Instructions:

Physician's Signature _____

PATIENT INSULIN PUMP CONTRACT

Patient Name _____ Date _____

Physician _____

I understand, as the patient, it is my responsibility to:

1. Maintain open communication with my physician, dietitian, and diabetes educator. This will include recording and reporting my glucose levels, carbohydrate intake, exercise, boluses, basal rate changes, and other information requested.
2. Perform glucose testing as requested.
3. I will change my infusion set every 2 to 3 days and follow the guidelines as set forth for proper pump management.
4. If hospitalized, I will bring all the needed equipment from home to ensure I have enough supplies. If I do not have the supplies, it is my responsibility to make arrangements to obtain them.
5. I will follow the formulas for meal boluses and correction factors prescribed to me by my physician and/or diabetes educator.
6. I will respond quickly and correctly to hypoglycemia and will report these to my health care team. I understand the “Rule of 15” to treat a low glucose with 15 grams of a fast-acting carbohydrate, retest in 15 minutes, and repeat the sequence if necessary.
7. I will respond quickly to hyperglycemia and prevent DKA by following the rules for sick-day management using my correction factor. I will report to my diabetes care team as needed, increase the frequency of monitoring, and test my urine for ketones if my glucose is over 240 mg/dl for 2 consecutive glucose readings.
8. I will not disconnect from the pump for longer than an hour. If I desire a “vacation” from the pump, I will first discuss this with my diabetes care team before doing so and follow their recommendations.
9. If I am having any difficulty with either pump use or carbohydrate counting, I will immediately call my diabetes care team for the proper assistance.
10. I will make sure that I have the proper supplies on hand at all times and that it is my responsibility to reorder supplies as I need them. I will also carry “emergency supplies” with me at all times, including syringes, in case my site becomes dislodged. I will also wear identification stating that I have diabetes and wear an insulin pump. This information will also include emergency contact, my doctor’s name, and telephone number.

Patient’s Signature _____ Date _____

LETTER OF MEDICAL NECESSITY

Date _____

RE: Patient Name _____ Phone () _____

Patient's date of birth _____ Insurance identification # _____

To whom this may concern:

This letter serves as prescription and letter of medical necessity for the above referenced patient for an insulin infusion pump as a lifetime need.

Check the following:

- ☐ Patient has had diabetes for ____ years
- ☐ Patient has the ability to regularly monitor blood glucose ____ to ____ times per day.
- ☐ Patient is motivated to achieve and maintain glycemic control and has the support needed to stay motivated.
- ☐ Patient demonstrates compliance with dietary regimen.
- ☐ Patient's insulin regimen consists of _____ to _____ injections per day.
- ☐ Patient has attempted several different regimens and/or has had multiple dose changes.
- ☐ Patient uses the following type(s) of insulin: _____.

Patient exhibits one or more of the following:

- ☐ A1c level ____% on ____/____/____.
- ☐ History of severe glycemic excursions and/or ☐ Nocturnal Hypoglycemia
 - ☐ Hypoglycemia unawareness ☐ Extreme insulin sensitivity or low insulin req.
- ☐ Widely fluctuating blood glucose levels before meals. (e.g., pre-prandial BG levels commonly exceed 140 mg/dl and/or are below 70 mg/dl. The range of these blood glucose levels is from ____ to ____.
- ☐ Dawn Phenomenon where fasting blood glucose often exceeds ____ mg/dl.
- ☐ Day to day schedule variations such as meal times, work schedules or activity level confound the degree of regimentation required to self manage glycemia with Multiple daily injections.
- ☐ Patient has been hospitalized or needed emergency assistance due to his/her diabetes.
- ☐ Patient has frequent hypoglycemic episodes, up to ____ times per week.
- ☐ Pregnancy or preconception with a history of poor glycemic control.
- ☐ Secondary complications requiring tighter glycemic control to slow or stop progression of
 - ☐ Retinopathy ☐ Neuropathy ☐ Nephropathy ☐ Other: _____
- ☐ Sub-optimal glycemic and metabolic control post-renal transplant.
- ☐ Patient has been fully informed of the risks and benefits of pump therapy.

PHYSICIAN NOTES

I certify that this information is complete and correct. _____
Physician's Signature

I am an endocrinologist, internist or diabetes specialist: ☐ Yes ☐ No

I am prescribing an insulin infusion pump, insulin pump supplies, and diabetes supplies for the following patient. The supplies may be refilled as necessary for one year. Please dispense as written.

PHYSICIAN NAME

PATIENT NAME

PHYSICIAN STREET

PATIENT STREET

PHYSICIAN CITY, STATE, ZIP

PATIENT CITY, STATE, ZIP

PHYSICIAN SIGNATURE

DATE

MEDICAL LICENSE NUMBER

UPIN NUMBER

INSURANCE COVERAGE FOR INSULIN PUMP THERAPY

Private Insurance

1. Contact pump company with information about the patient
 - A. Insurance information
 - B. Indications that would require utilizing the insulin pump
 - C. Must be on multiple insulin injections (2 or more a day)
 - D. Cover type 1 and some type 2 diabetes
 - E. Prescription from MD

Medicare

1. Contact pump company with patient's information
2. Must meet criteria for insulin pump therapy
 - A. C-Peptide of less than 0.6 mcg/L
 - B. A1c over 7%
 - C. Monitoring 4 times a day
3. Medicare pays 80% for pump and supplies. Secondary insurance may cover the other 20%. If Medicare denies coverage, secondary may cover.

Medicaid

1. Contact pump company with insurance information
2. Must meet criteria for insulin pump therapy
2. Prescription from MD
4. Medicaid will cover 100%

Indications for Insulin Pump Therapy

1. Unable to normalize glucose levels
 - A. Erratic glucose excursions
 - B. A1c over 7%
2. Severe episodes of hypoglycemia or hypoglycemia unawareness
3. Preconception/pregnancy
4. Early chronic complications
5. Organ transplant
6. Patient desires better control
7. Prevent chronic complications

OVERVIEW FOR PUMPING INSULIN

Indications For Insulin Pump

1. Multiple episodes of severe hypoglycemia
2. Erratic glucose levels – “brittle diabetes”
3. Early complications
4. Organ transplant
5. Pregnancy

Advantages of The Pump

1. More flexible lifestyle
2. Improved overall control
3. Prevent chronic complications
4. Improve control during exercise and “growth spurts”
5. Tight control during pregnancy

Characteristics of Pump Candidate

1. Must be willing to monitor BG several times a day
2. Must be willing to count carbohydrates
3. Must have manual dexterity to use buttons on pump and have good visual acuity to see the screen
4. Good support system
5. Committed to self-care
6. Ability to problem solve
7. Good basic knowledge of diabetes
8. Reasonable expectations of what the pump can do

Time Line

1–2 months before pump start:

1. Assess patient’s current knowledge about diabetes
2. Assess whether or not patient meets the criteria for a “pumper”
3. MD contacts the pump company and writes orders for the pump
4. Patient is seen by dietitian for carbohydrate counting
5. Patient is seen by the pump trainer for general assessment and education

QUESTIONNAIRE

Are you ready for pumping?

1. How motivated are you to achieve good control?

Not very 0 1 2 3 4 5 very _____

2. How many times do you test every day?

0 1 2 3 4 5 _____

3. How many injections per day?

0 1 2 3 4 5 _____

4. Do you keep a record?

Yes (5 points) No (0 points) _____

5. Do you adjust your insulin for test results?

Yes (5 points) No (0 points) _____

6. Do you adjust your insulin for meals?

Yes (5 points) No (0 points) _____

7. Do you adjust insulin for “highs”?

Yes (5 points) No (0 points) _____

8. Do you adjust your insulin for exercise?

Yes (5 points) No (0 points) _____

9. Do you get regular A1c tests?

Yes (5 points) No (0 points) _____

10. Do you call your doctor when you have a problem?

Yes (5 points) No (0 points) _____

SCORING

Score	What It Means
0–9	Are you in charge or someone else?
10–19	At least you're honest!
20–29	Where can you improve?
30–39	Just a few minor changes
40–49	How soon can you start?

1–2 weeks before pump start

1. Patient watches video or DVD on pump use several times to begin familiarizing him/herself with the pump
2. May attend “Pump School” via Internet
3. Meets with pump trainer for basal, bolus, correction factor, and insulin to CHO ratio

Day before pump start

1. Discontinue use of long-acting insulin
2. Continue injections of Humalog/Novolog before meals
3. Use “correction formula” to cover for highs

Day of pump start

1. Eat breakfast and take fast-acting insulin as usual
2. Wear comfortable clothing-preferably two-piece outfits
3. Allow 3 hours for training
4. Bring with you:
 - Pump
 - User's Manual
 - Infusion sets — at least 2
 - Cartridges — at least 2
 - Skin prep
 - Glucose meter/strips/lancets
 - Alcohol wipes
 - Insulin (Novolog or Humalog)
 - Carbohydrate snack
 - 2 Batteries

First day after beginning pump therapy

1. Call Pump Trainer with glucose readings and grams of carbohydrate
2. Begin “4 Day Plan”

Within 3–5 days after pump training

1. Come in to office for follow-up
2. Continue “4 Day Plan” until basal rates are adjusted correctly

When basal rates correct,

1. Adjust insulin to carb ratio
2. Begin “3 Day Plan”
3. Call Pump Trainer with BG readings and CHO grams

Weekly for 4 weeks

1. Call Pump Trainer with BG’s and CHO grams for adjustment
2. Basals are adjusted first, then boluses

STARTING BEGINNING BASAL RATE

Total Daily Pre-pump Insulin x 75% = Total Daily Insulin per Pump
(total pre-pump dose minus 25%)

Divide the new dose by 2
Half is basal; half is boluses

For basal, divide half by 24 = basal rate per hour

Begin with 1 basal rate and adjust as needed

Example:

TDD pre-pump — 50 units

$50 - 25\% = 38$ — new dose

$38 \div 2 = 19$ (19 units for boluses; 19 units for basal)

$19 \div 24 = 0.79$ units per hour (may round up to 0.8 units per hr.)

INSULIN TO CHO RATIO: RULE OF 500

Divide 500 by the new total daily dose:

Example:

TDD = 25 units

$500 \div 25 = 20$ — 1 unit of insulin per 20 gms of CHO

TDD = 45

$500 \div 45 = 11$ — 1 unit of insulin per 11 gms of CHO (may round down to 10 for ease)

INSULIN CORRECTION FACTOR: RULE OF 1500

Divide new TDD into 1500

Example:

TDD = 45 units

$1500 \div 45 = 33$ (amount 1 unit of insulin will decrease glucose level by)

If target level is 100 and glucose level 289 mg/dL – how many units to get BG level to 100?

$289 - 100 = 189$ (189 points above target)

$189 \div 33 = 5.7$ units of insulin

Used to correct for a high

May be added to regular mealtime bolus if high occurs right before eating a meal

MONITORING SCHEDULE

For first few days to 2 weeks (or until basals and boluses adjusted)

1. Between 2:00–3 a.m. (Dawn Phenomenon)
2. Fasting (overnight basal) Goal 70 – 100 mg/dL
3. 2 hours after each meal Goal 140 mg/dL or less
4. Before and after exercise
5. Before driving
6. If hypoglycemia is suspected

ADJUSTING BASALS – “4 DAY PLAN”**Overnight Basal**

1. First basal to be checked
2. Eat regular dinner (no later than 7:00 p.m.), NO bedtime snack

3. BG @ bedtime should be 100-150 mg/dL
4. Test BG every 2 hours between supper and bedtime, @ Midnight, and 3:00 a.m.
5. If BGs stay within 30 mg/dl basal OK — if more than 30, adjust
6. Divide night into 3 “test windows”
 - a. BEDTIME: 9:00 P.M. to midnight
 - b. NIGHT: Midnight to 3:00 a.m.
 - c. DAWN: 3:00 a.m. to 7:00 a.m.

Afternoon Basal

1. Eat breakfast and take bolus for food
2. NO lunch, NO bolus
3. Check BG every 2 hours between breakfast to supper
4. If BGs stay within 30 mg/dl, basal OK; if not, adjust

Morning Basal

1. NO breakfast, NO bolus
2. Test BG every 2 hrs from waking until lunch. DO NOT SLEEP IN!
3. If BGs stay within 30 mg/dl, basal OK; if not, adjust

Evening Basal

1. NO supper NO bolus
2. Test BG every 2 hrs between lunch & bedtime snack at 10:00 p.m.
3. If BGs stay within 30 mg/dl, basal OK; if not, adjust

NOTE — DO NOT “fix” a high glucose during the time you are checking your BGs every 2 hours. Correct at the next scheduled meal, using your correction factor. If you miss a day — continue the plan the next day. May need to repeat the “4 Day Plan” two or three times until the basal rates are corrected.

ADJUSTING INSULIN TO CHO RATIO

1. Check 2 hours after each meal
2. If BGs not over 140 mg/dL, ratio correct; if higher — increase, if lower — decrease
3. May have 2-3 different ratios during the day — may need 1 unit per 8 gms in a.m., 1 unit per 10 or 15 for lunch and dinner, or 1 per 8 in a.m., 1 per 10 for lunch, and 1 per 15 for dinner.

ADJUSTING CORRECTION FACTOR

1. If hypoglycemia occurs after correcting for a high, lower correction factor
2. If BG still high after 3–4 hours, increase factor.

OTHER TIPS AND SAFETY

1. Change site every 2–3 days (every other day with pregnancy). ALWAYS do site changes in the MORNING — NEVER at bedtime! Check BG 2 hours after a site change to ensure the “cath” is placed correctly and pump is functioning properly
2. Inspect site twice a day — if swelling, redness, pain, or drainage — CHANGE SITE!
3. ALWAYS carry extra supplies with you in case the catheter gets dislodged
4. ALWAYS have a supply of syringes on hand in case of pump malfunction
5. ALWAYS wear identification stating you have Diabetes and wear an insulin pump
6. If you have 2 BGs over 240 mg/dL in a row — inject insulin according to the correction factor and CHANGE SITE. Retest 2 hours after
7. NEVER NEVER NEVER go to bed with a low battery
8. If you perspire heavily, may use a solid non-fragrance antiperspirant around site or try other types of tape that are available. Skin Tac “H”, Polyskin, Tegaderm, Hypafix, HyTape, Dermicell, SkinPrep, Mastasol, and toupee glue are other options to try.

GOING OFF THE PUMP

1. Be sure you check with your doctor before disconnecting from the pump for any length of time.
2. DO NOT disconnect for more than 1-2 hours unless you have the OK from MD.
3. Reasons to go off the pump may be due to pump malfunction — call 1-800-send pump — the pump manufacturer will immediately send a loan pump until yours is repaired or replaced. Another reason may be just a desire to have a “vacation” from the pump.

Time Off Pump

Action

1–1½ hrs

No action unless CHO will be eaten or BG is high

1½–5 hrs.

Before disconnecting, give a bolus to replace 80% of the basal that will be lost

Inject before eating using insulin to CHO Ratio

DAYTIME ONLY

Give injection before each meal by using your insulin to CHO ratio PLUS the basal insulin needed until the next meal

3–4 Days or More

Inject fast-acting insulin before each meal using your insulin to CHO ratio and correction factor for highs. At bedtime, inject Lantus to equal 1.5 X the basal rate used for the overnight period.

TRAVELING

1. ALWAYS carry at least 1 weeks' worth of extra supplies on top of what you will normally use — if you are staying for 2 weeks, carry supplies for 3 weeks.
2. NEVER check your supplies in baggage — CARRY them with you.
3. Carry snacks with you.
4. WEAR IDENTIFICATION stating you have diabetes and wear an insulin pump.
5. Remember to change the time on your pump if you will be crossing time zones.
6. Get a letter from your doctor explaining what to do for your diabetes, listing medications and devices that you may use. The letter should also state any food or medication allergies you may have. Also get a prescription to carry with you for any medications you may need. Know the name and number of an endocrinologist in the area where you're traveling may prove useful.
7. Carry bottles of insulin IN THEIR BOXES with your name, doctor's name, your pharmacy's name, and medication on a pre-printed label.
8. Contact your airline for any specifics — different airlines have different rules regarding diabetes supplies — don't be surprised!
9. The pump can be worn through the scanner at the airport without causing it harm. Don't call attention to it.

HOSPITALIZATIONS

1. Remove pump for X-rays, MRIs.
2. Be prepared beforehand — carry a letter from your endocrinologist with orders for you to keep the pump on, check your own glucose levels and do your own adjustments.
3. If you are unable to care for the pump, have a family member do so. If you have no family with you, the pump may be removed, but ONLY after the nurses have orders for insulin coverage. DKA can occur much faster after disconnecting from the pump because there is no long-acting insulin on board.
4. The pump gives better control during and after surgery, so ask doctors to allow that it stay connected. As soon as possible after surgery, ask to have the pump reconnected if it was discontinued during the surgery.
5. Pregnant patients will need to move insertion site to the thigh area immediately after beginning labor and leave the pump connected during labor. Insulin resistance dramatically decreases after the placenta is delivered — so be prepared to decrease basal rates. Basal rates will remain lower if the mother is breast feeding also.

**STANDARDS OF CARE:
DIABETES EDUCATION AND MANAGEMENT PROGRAM**

Insulin Pump Education: Up to 8 Visits

A. Initial visit/s prior to pump start, CDE:

1. Data collection & review; assessment of self-management skills, readiness to learn and barriers to learning
2. Prerequisites for successful pumping:
 - a. One month of multiple injection therapy with Lantus and Humalog or Novolog
 - b. Many BGs showing testing at least 4 times a day for one month
 - c. Knowledge of pump function through watching video or doing on online pump program
3. Intro to pumps; basal & bolus rates, insertion sites
4. Refer to RD for dietary counseling and CHO counting assessment
5. Assess glucose meter skills
6. Resources: videos, books, pamphlets, web sites
7. Goal setting

B. Initial visit/s prior to pump start, RD:

1. Data collection & review; weight, food record
2. Review of meal planning and CHO counting
3. Validate ability to count carbs at home, at work or school, at restaurants and fast-food locations
4. Goal setting

C. Follow-up visit, day of pump start, CDE (3–4 hours):

1. Pump specifics; buttons, syringe filling, priming, insertion technique
2. Initial settings
3. Problem solving, alarms
4. Restocking supplies
5. Hypoglycemia and hyperglycemia management, DKA prevention
6. Review of tasks and follow-up plan
7. Status of goals and reinforcement of positive changes
8. Resources: videos, books, pamphlets, web sites
9. Goal setting

D. The CDE will emphasize that regulating basal and bolus rates and determining insulin to carb ratios is essential until the blood sugars are within the preset goal ranges. Telephone support for emergencies is available 24 hours per day.

E. Follow up visit, within one month or more frequently if needed, CDE:

1. Data collection & review; blood sugar trends, meter download
2. Review basal & bolus rates
3. Review of site adequacy & insertion technique
4. Confirm completion of basal rate testing
5. Sick day management/DKA prevention.
6. Status of goals and reinforcement of positive changes
7. Goal setting

F. Follow-up visits with RD as needed.

1. Data collection & review; blood sugar trends, food records
2. Review of meal plan and carb counting
3. Review of food adjustments for sick days and exercise
4. Status of goals and reinforcement of positive changes
5. Goal setting

G. Follow-up visits (quarterly for first year then annually) with CDE:

1. Data collection & review; blood sugar trends, A1c results
2. Self-management review and problem solving
3. Status of goals and reinforcement of positive changes
4. Goal setting
5. If child, movement toward independence in diabetes care

INSULIN PUMP FOLLOW-UP

Patient Name _____ Date _____

Certified Pump Trainer _____

Pump Model _____ Serial # _____

BASIC REVIEW	SITE CHANGE PROTOCOL

ADDITIONAL FEATURES INSTRUCTED:	NOTES

BLOOD GLUCOSE RECORD

DATE	TIME	BG	CHO GRAMS	INSULIN

Basal Rate Changes:

From 12 Midnight to _____ : _____ units per hour

From _____ to _____ : _____ units per hour

From _____ to _____ : _____ units per hour

From _____ to _____ : _____ units per hour

Pump Trainer Signature _____ Date _____

INSULIN PUMP CONTACTS

Trainer: _____

Phone: _____

Alternate trainer: _____

Alternate phone: _____

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