

INSULIN PUMP THERAPY #1: THE BASICS

WHAT IS AN INSULIN PUMP?

An insulin pump is a small, battery-powered, mini-computer insulin delivery device. It can be tubed or tubeless. For both types of pump, insulin is delivered under the skin through a small, soft Teflon cannula (tube). Both types of pump have a reservoir filled with rapid-acting insulin (Humalog®, NovoRapid® or Apidra®). Both the infusion sets for tubed pumps and the tubeless pumps must be changed every 2-3 days.

Tubed pumps are about the size of a deck of cards and are worn clipped to a belt or waistband, or in a pouch or pocket, and they are attached to the infusion tubing and cannula. The cannula is introduced under the skin using a small needle, which is then discarded. Tubed pumps can be disconnected from the infusion set only for **short** periods for swimming, bathing and occasionally for exercise.

A **tubeless** pump ("pod") is worn attached directly to the skin, the cannula projecting from the underside of the pod. The cannula is inserted under the skin with an introducer needle, which then retracts into the pod. Tubeless pumps are operated wirelessly with a small electronic device ("PDM"). Once inserted, a tubeless pump cannot be removed until its useable life is finished.

The insulin pump is **not** automatic, and it is not considered an "artificial pancreas". It must be programmed to give insulin when needed. The "official" term for insulin pump therapy is continuous subcutaneous insulin infusion (CSII). Insulin pump therapy and multiple daily injections (MDI) are called intensive diabetes management because it is possible to keep blood sugars in a tighter range. Blood sugars must be checked at least 6 times a day for pump therapy to be safe and effective. **The insulin pump itself does not monitor blood sugar!** Real-time continuous glucose monitoring (CGM) is available and can work with some insulin pumps. This is with a transmitter and a sensor, inserted separately from the pump site. CGM measures sugar found under the skin (in the "interstitial fluid"), not blood sugar. A couple newer pumps can stop insulin delivery based on sensor glucose readings. These are called "hybrid closed-loop" systems.

HOW DOES IT WORK?

An insulin pump tries to imitate what normally happens in the body. It can deliver insulin in exact amounts, as small as 0.025 units per hour. The insulin is delivered in 2 ways:

- **Basal:** a small amount of background insulin delivered continuously 24 hours a day. The basal rate keeps the glucose levels in the target range when no food is eaten (between meals and overnight). The pump can be programmed to deliver different basal rates throughout the 24-hour period, based on individual needs. Once the basal rates are set correctly, they need to be fine-tuned with growth or major changes in routine. Temporary basal rates are used for activity, illness, menstrual cycle, or other temporary changes in routines.
- **Bolus:** a larger amount of insulin delivered over a short period of time. A bolus can be given anytime, but **cannot** be pre-programmed. A **pre-meal** bolus is given based on the grams of carbohydrate to be eaten. A **correction** bolus is an extra amount of insulin given when the blood sugar is high.

Starting basal rates, bolus doses, insulin-to-carbohydrate ratios and correction formulas are set with the diabetes team according to each person's unique needs.

WHAT ARE THE BENEFITS OF INSULIN PUMP THERAPY?

1. **Precise dosing.** Insulin delivery is exact and matched to each person's unique needs. This makes it possible to keep blood sugars close to normal most of the time. It is also easier to manage the dawn phenomenon, growth spurts, sleeping in, overnight lows, illness and fussy eaters.
2. **Flexibility.** There is flexibility in the timing and size of meals. If programmed properly, blood sugars can be managed better during travel, exercise, illness, or with unpredictable schedules.
3. **More predictable absorption** of insulin because only rapid-acting insulin is used and mainly one area is used. This eliminates the problem of different absorption rates from different sites. The abdomen, buttock and hip area are the usual sites used.
4. **Fewer and less severe lows** because of more predictable and precise insulin delivery.
5. **Improved control of diabetes.** If the pump is used properly pump users may have better control of diabetes than they were able to get with injection therapy.

WHAT ARE THE CHALLENGES OF INSULIN PUMP THERAPY?

1. **Risk of ketoacidosis (DKA).** The pump only uses rapid-acting insulin. There is no deposit of long-acting insulin in the body. An interruption to the insulin delivery will cause blood sugars to rise quickly. Ketones can start developing in a few hours without insulin. Extra care needs to be taken to prevent and manage high blood sugars. Pump users must always carry an insulin pen with rapid-acting insulin and be prepared to use it if they have 2 unexplained high blood sugars in a row. They also need to check for **ketones** when the blood sugar is over 15 mmol/L and with any nausea or vomiting.
2. **Infection at the infusion site.** Site rotation is just as important as it is with pens or syringes. Infusion sites need to be rotated and changed every 2-3 days.
3. **Hypoglycemia.** For some people, tighter control of blood sugars can lead to more lows, although they are usually less severe.
4. **Weight gain and suboptimal nutrition.** Improved control of blood sugars can lead to weight gain, especially if there is increased snacking. Parents need to make sure children are still meeting their nutritional requirements.
5. **Body image concerns/psychological adjustment.** Some people don't like the idea of being attached to a device all the time.
6. **Steep learning curve.** Education is crucial for pump therapy to be successful. There is a lot of preparation and required reading while learning how to use an insulin pump. Today's insulin pumps are 'smart pumps' with lots of features. The information can be uploaded and reviewed. It is important to use the pump's 'smartness' because otherwise it is just an expensive syringe!

COST?

The cost of a pump depends on the pump you choose. Currently, [BC PharmaCare](#) will completely cover the cost of the Omnipod tubeless pump system PDM (Tier 1) for all ages. Ypsomed (also Tier 1) consists of a starter kit (\$800) which is applied to your deductible. For those approved by the [Special Authority process](#) for exceptional coverage of another pump brand (Tier 2), coverage is dependent on your [PharmaCare plan](#) and any associated deductible and family maximum. If you are covered under [Plan C](#) (B.C. Income

Assistance), **Plan F** (Children in the At Home Program), or **Plan W** (First Nations Health Benefits), PharmaCare covers 100% of the cost. If you are covered under the **Fair PharmaCare** plan, PharmaCare covers 70% of costs above your deductible and 100% of costs above your family maximum. Tandem pumps are currently not covered by Pharmacare. Many extended health plans will also cover up to 80% of the cost of a pump. **Pump supplies** (infusion sets, reservoirs and tubeless pods) cost about \$300-500 per month, depending on the insulin dose and frequency of site/pod changes, and these are also covered by **BC Fair PharmaCare** and extended health plans. **BC Fair PharmaCare** and some extended-benefit providers do not pay for continuous glucose monitoring systems and sensors.

INSULIN PUMP MANUFACTURERS (in alphabetical order):

- **Insulet:** <https://www.omnipod.com/en-ca/home> or Canada toll-free number: 1-855-763-4636
OmniPod DASH® System
Contact: Andrew Muirhead (amuirhead@insulet.ca), phone 604-754-6195
Online training support program: https://www.omnipod.com/en-ca/DASH_video
- **Medtronic Diabetes:** www.medtronicdiabetes.ca or Canada toll-free number 1-800-284-4416
MiniMed® 770G insulin pump with SmartGuard™ technology
Contact: Brenda Heaney (brenda.heaney@medtronic.com), phone 604-312-7101
Online product training courses: [Virtual demo pump | Medtronic Diabetes Canada](#)
- **Tandem Diabetes:** <https://www.tandemdiabetes.com/> or Canada toll-free 1-833-509-3598
t:slim X2™ insulin Pump with Basal-IQ and Control-IQ technology with Dexcom G6®
Contact: Teri Currie (tcurrie@tandemdiabetes.com), phone 778-995-1268
Demo apps: t:simulator app available from the Apple Store and from Android Play
- **Ypsomed:** www.ypsomed-diabetescare.com/en-CA/ or Canada toll-free 1-833-695-5959
YpsoPump® insulin pump with Ypsomed App
Contact: Sarah Brykajlo (sarah.brykajlo@ypsomed.com), phone 604-805-6384
Handling videos: www.ypsomed-diabetescare.com/en-CA/services/handling-videos.html

BOOKS ON INSULIN PUMPS (suggested reading): These books are available for purchase online at www.amazon.ca or www.chapters.indigo.ca.

- *Pumping Insulin: Everything You Need for Success With an Insulin Pump (6th ed.)* (www.diabetesnet.com/pumping-insulin) by John Walsh and Ruth Roberts, Torrey Pines Press, ©2016.
- *The Calorie King® Calorie, Fat & Carbohydrate Counter* (www.calorieking.com) by Allan Borushek, ©2021. Android and iOS apps also available.

ADDITIONAL QUESTIONS?

If you have additional questions, you can e-mail our insulin pump educators at dcnurse@cw.bc.ca or leave a message at the Diabetes Clinic at 604-875-2868.

ARE YOU READY?

Read the checklist on the next page to see if you and your family are ready to move forward with insulin pumping or if you still have things to work on.

For more information on using Continuous Glucose Monitoring, see our handout
Continuous Glucose Monitoring (CGM) #1: The Basics

ARE YOU READY TO PUMP?

- You and your family have mastered the basics of diabetes care, and you have demonstrated an understanding of how to match insulin to food and exercise. Your family life has adjusted to the diagnosis of diabetes. For most families, this takes several months.
- You have been using basal-bolus insulin therapy (MDI) for at least 3-6 months.
- You have been checking blood sugars **at least** 4 times a day **and** recording the results in a logbook or uploading the results weekly **OR** you are using a CGM and checking with meter when appropriate. You are also entering all carbs and insulin doses.
- You and your parents **analyze** your blood sugars regularly (minimum every 2 weeks) and can independently make insulin adjustments when needed.
- You want to improve blood sugars and have a more flexible lifestyle.
- Child **and** both parents are interested. This includes younger children.
- You have a computer (or access to one) to upload the pump and analyze reports.
- You have read the handout on [Insulin Pump Therapy #1: The Basics](#), available on our website, and completed the *Pump Readiness Assessment*.
- Once on the pump, you are prepared to check glucose readings 9-10 times a day including night checks at midnight and 3:00 AM for the first few weeks, then a minimum of 6 times per day with monthly night checks. This can be done with fingersticks or a CGM.
- You and your family have realistic expectations about what an insulin pump can and cannot do and the time commitment involved in getting started.
- You can already count carbohydrates accurately. See handout [Carbohydrate Counting](#). You will have to have worked through our entire [Carb Counting Quiz](#) handout before starting the pump. You can also take a look at [online carb counting module](#).
- You rotate injection sites and use your abdomen regularly. You do not use EMLA for injections.
- For teens, you allow your parents to be involved and participate in your diabetes care.
- For younger children, parents need to know that daycare personnel may not be able to operate the pump. This needs to be discussed directly with the school and/or daycare. A parent must be available at all times in case of problems.
- You and your family are prepared to attend pump readiness and education sessions and do all of the required home reading/preparation and follow-up.
- Your family is registered with [BC Fair Pharmacare](#).

If you feel you're ready to move ahead with insulin pumping, then look up our handout
[Insulin Pump Therapy #2: You've Decided on a Pump — Now What?](#)