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# The Artificial Pancreas is here - closed-loop insulin pumps with integrated CGM

In 2020 the artificial pancreas (AP) became a reality for individuals living with Type 1 diabetes, almost 100 years after the discovery of insulin. The AP was achieved through closed-loop functionality - the ability of an insulin pump to automatically & safely deliver basal (background) & rapid (meal-time) insulin to provide optimal glycemic (blood sugar) control. Closed loop technology became available through great coding & dramatic advances in CGM/sensors over the last few years.

See this youtube recording of our The Weekly HCL pump webinar from 2020-May-14.

See the table below for a list of HCL pump systems available as of 2020-May-14.

**HCL pump options Canada 2020-May-14**

| Name | Pharmacare? | sensor | software | tubing | smartphone control? | add-on required? |
|---|---|---|---|---|---|---|
| obsolete Medtronic pump | no | Dexcom G6 | Loop* | yes | iPhone only | Riley link |
| Omnipod | yes | Dexcom G6 | Loop* | no | iPhone only | Riley link |
| Medtronic 670G | yes** | Guardian | proprietary | yes | coming soon | no |
| Tandem T-slim X2 | not yet | Dexcom G6 | proprietary | yes | not yet | no |

Click here for a pdf document that compares the functionality of all production insulin pumps on the Canadian market as of 2019-Dec-30. As of 2020-Aug-28 four insulin pumps are covered by BC Pharmacare though the Medtronic 670G is the only one with out-of-the-box HCL capability. Ironically, the CGM required for HCL capability as of 2020-Aug-28, is not covered by Pharmacare. BC Pharmacare coverage is complex because of the deductible - be sure to read the fine print.

HCL functionality became available to retail consumers in Canada in late 2018 with the Medtronic 670G pump/CGM system. Experimental *non-retail hybrid closed-loop systems with all the features of production hybrid closed-loop systems like the Medtronic 670G have been available for several years (see "Looping" below).* With the Medtronic 670G system optimal basal insulin infusion rates can be set up by allowing

the sensor/CGM to record 2+ days of glucose data during the basal state. Activation of the “auto” function implements the optimized basal rates which then run automatically while the sensor/CGM checks the sugar every 5 minutes. If the sugar drops below <6.7 (or 8.3 if in "exercise" mode) or rises above 14.0 the basal infusion will be automatically stopped & only restarted once the sugar level moves into the 6.7-13.9 range. This results in more Time in Range (Time to Target), fewer lows (in particular fewer severe lows) and better A1c.

The Tandem "basal IQ" pump, combined with the Dexcom G6 CGM came to market 2020-Apr-1 and is a direct competitor of the Medtronic 670G. On 2020-Dec-01 improved HCL software for the Tandem pump “control IQ” was approved by Health Canada and will likely be available to consumers to download 2021-March. Here is a comparison of the Medtronic 670G and the Tandem basal IQ.

The Omnipod Horizon closed loop system, also developed in partnership with Dexcom, is being tested pre-release in the USA - it is not expected in Canada until late 2022. tidepool.org application for the Loop app (see below) is under consideration by the US FDA.

Lilly also has a hybrid closed loop system under development as well as a smart pen system for rapid insulin boluses.

Looping

High quality HCL, not currently approved by the FDA or Health Canada, is also available using do-it-yourself, open-source, “looping” software. People who use looping technology are called “loopers’. There are currently three looping systems available to Canadians: Loop is the best IMHO and is discussed in detail below (OpenAPS and AndroidAPS are the other two systems).

BCDiabetes’ recommendation for loopers is the tubeless Omnipod system running with Loop (compatible with iPhones only but coming to Android phones 2021-Feb). Forty current BCDiabetes patients are currently using this system. BCDiabetes recommends this system over the retail systems discussed above (Medtronic and Tandem) as it currently gives the best blood sugar control, because of Omnipod’s low cost and its coverage by BC Pharmacare. Once CGM is covered by BC Pharmacare this fantastic option will be affordable for most technology savvy British Columbians living with Type 1 diabetes.

On 2020-Aug-1 BCDiabetes began doing installations of the Omnipod-Dexcom G6-Riley link Loop system in house - here is a one-pager with the requirements as well as a powerpoint from the webinar from May 20. We will configure all the software &, with your consent, do the installation. Ideally you will bring your own iPhone (5S or newer), and will already be wearing an Omnipod pump and a Dexcom G6 - if so we will have you up and running in 90 minutes. If you don't have an Omnipod we will fill out the two necessary forms (one & two) to get it covered by BC Pharmacare and it will be delivered to you. You can purchase a Riley Link at cost from us ($200; the alternative is ordering it from the US for the same price and waiting 3 weeks). If you don't have a compatible iPhone and can't afford a Dexcom G6 or Riley Link talk to us - we may be able to help.

If you have questions or want to make the jump to looping you can find information by joining the "Looped" Facebook group or feel free to email Nadine Pedersen, a local volunteer for the NightScout Foundation.

Short URL version of this document is http://bit.ly/2QO2Xpk