

## INBRIEF

Summarizing the Evidence

# Hybrid Closed-Loop Systems for Type 1 Diabetes

## Key Messages

- Hybrid closed-loop systems generally increase the amount of time a person is in their target blood glucose ranges compared with other insulin delivery methods.
- For people with type 1 diabetes, and their caregivers, hybrid closed-loop systems can decrease the amount of time and energy spent on diabetes management.
- While the short-term data look promising, there haven't been any studies that follow research participants for extended periods of time.
- Based on a health technology assessment, CADTH's expert committee recommends reevaluating the data in the coming years as more long-term data becomes available.

## Context

People living with type 1 diabetes are unable to make their own insulin (a hormone that manages blood sugar, also called blood glucose). Without insulin, type 1 diabetes causes high blood sugar. Symptoms can include excessive thirst or urination, blurred vision, and headaches. Long-term complications can include kidney damage and nerve damage, and some other important long-term issues. Blood glucose monitoring and insulin delivery are very important to the management of type 1 diabetes. All people living with type 1 diabetes need insulin therapy to manage their blood glucose levels.

## Technology

Hybrid closed-loop insulin delivery systems (HCL systems) consist of an insulin pump, a continuous glucose monitor, and a computer program that allows the pump and the monitor to communicate with each other and automatically calculate how much insulin is needed. These systems are designed to help keep blood glucose levels within a certain range. It's called a hybrid system, as the user still must manually account for individual insulin needs — for example, before eating — and confirm the amount of insulin to be delivered.

## Issue

In Canada, HCL systems became commercially available in 2018. Coverage of technologies to manage type 1 diabetes varies across Canada — as to which technologies are publicly covered and also as to which part of the health care system is responsible for this coverage. As technologies for diabetes management are quickly evolving, it is important to know what the evidence says about HCL systems.

## Methods

CADTH conducted a health technology assessment of HCL systems used by people with type 1 diabetes. CADTH looked at:

- how well HCL systems help manage a person's type 1 diabetes compared to other insulin delivery methods
- the safety of HCL systems
- the budget impact from the viewpoint of the Canadian health care system
- perspectives and experiences of people living with type 1 diabetes and their caregivers
- ethical issues related to HCL systems.

## Results

HCL systems generally increased the amount of time a person spends in their target blood glucose ranges compared with other insulin delivery methods. HCL systems improved other diabetes management measures (e.g., hemoglobin A1C, average blood glucose, and glycemic variability) compared with other therapies. People who use HCL systems reported small improvements in quality of life and satisfaction, but this was not always statistically significant; it's not certain whether this is a consistent finding, especially over longer follow-up periods and for studies with more people. The time frame of the studies in this review ranged from 2 days up to 6 months.

HCL systems appeared to be as safe as using other insulin delivery methods. Adverse events such as too low blood sugar and ketosis-related events were not different between those who used HCL systems compared to other interventions.

The budget impact analysis estimated that the cost of reimbursing HCL systems for people with type 1 diabetes who are eligible for insulin pumps compared with currently reimbursed technologies would be \$823 million. This is for a 3-year period and from a pan-Canadian perspective. It's uncertain how many people with type 1 diabetes will choose to use HCL systems. If current users of multiple daily injections do not switch to HCL systems, the budget impact is estimated to be lower (\$97 million).

For people with type 1 diabetes and their caregivers, HCL systems may decrease the amount of time and energy spent on diabetes management and enable users to be more immersed in other aspects of their lives. However, people will need to trust the control algorithm to adjust things like basal insulin rates. Learning to see HCL systems as partners in care, rather than tools providing care, may help develop this trust and ease frustrations with technical complications. Health care providers appreciated the depth of data HCL systems offered but also acknowledged the importance of not confusing this data with the needs of the person living with type 1 diabetes.

The ethics analysis in the CADTH health technology assessment review highlighted the non-clinical and short-term clinical benefits of these systems but noted the uncertainty of whether the overall health of people with type 1 diabetes might improve over the long term. Education and support for people using these devices are important considerations. It's uncertain who might benefit most from using HCL systems and this could impact public coverage of these devices.

## Recommendations

Based on the health technology assessment, CADTH's expert committee recommends reevaluating the data in the coming years as more long-term data becomes available. The committee also recommends collecting more high-quality data that compares HCL systems to other methods of insulin delivery and glucose monitoring.

Read more about CADTH and this topic at:  
[cadth.info/hybridclosedloop](https://cadth.info/hybridclosedloop)



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CADTH receives funding from Canada's federal, provincial, and territorial governments, with the exception of Quebec.

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