# **Co-designing an Accessible Insulin Pump for Individuals who are Blind or Partially Sighted**

## Authors:

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## Executive Summary

It has been 100 years since the discovery of insulin and nearly 35 years since the first insulin pump. Insulin pump therapy is a type of diabetes treatment that provides insulin infusions rather than multiple daily insulin injections. Diabetic retinopathy is the leading cause of premature blindness in Canadians of working age, and it is a potential complication for nearly one-third of diabetics. Despite the importance of an insulin pump, many features of an insulin pump have not been designed to be universally accessible for people with diabetes who are partially sighted, Deafblind, or blind.

CNIB clients have raised numerous obstacles related to the inaccessibility of these devices. Current devices often lack the necessary audio feedback for individuals that solely rely upon a visual display for operating important features. Therefore, we conducted an environmental scan to gather information on the policy and regulatory landscape around medical device accessibility, as well as the existing features and user instructions on insulin pumps. Following our scan, we held co-design sessions to help identify the features of an accessible insulin pump for those who are blind, Deafblind, or partially sighted and living with diabetes in the summer of 2021.

The data from the co-design sessions was classified based on features considered as either beneficial, modifiable, or inaccessible. The tactile buttons on the pump have been shown to be advantageous, even to the point of memory and counting of button presses for the quantity of insulin units.

Furthermore, the device's portability as an alternative to insulin pens and the option to turn off notification alert noises were both beneficial. In terms of features suggested to be modified, was the menu navigation to change settings for basal rates and specify desired bolus unit per button increments.

Additionally, a much-needed universal holster or pouch to carry the device and upgrades that allow voice-over controls that are compatible with an end user-friend application.

Moreover, inaccessible elements included the difficulty of bolus controls, configuring insulin unit increments, and no confirmation of dosage calculation after button strokes. In addition, unclear alarm tones related to similar noises for low battery and low reservoir, alert is undecipherable based just on comparable audio-alert. The dosage security for insulin units is inaccessible based on the lack of protection surrounding dose verification before delivery of insulin.

The co-design sessions unveiled requests for customizable haptic and tactile features, user-friendly operating handbooks available in multiple formats, and descriptive notification tones for greater autonomy in diabetes management. In sum, other elements included:

* **Validation** **of insulin units** ahead of administration.
* Suggested **history record of basal rates** and previous bolus quantities using **streamlined menu** navigations.
* **Recognizing** **gender differences** in technology use, diabetes management networks, and information sharing.
* Discreet and **cross-sensory haptic options** for communicating device feedback including **speech output capabilities**.

The recommended design modifications based on this research included having the option to personalise or adapt feature settings for a variety of diverse lifestyle needs. Such considerations would allow individual feature preferences and offer choices for speech options, vibration alerts, or set unique tones. Furthermore, tones must be truly recognisable sounds when alerting for low battery or low reservoir, and distinct from any security tones for dosage validation, and infusion-site delivery confirmation.

Some individuals were hesitant in upgrading their medical device, in fear of losing the current level of accessible features, despite wanting to upgrade their outdated device. Individuals would further rely upon sighted assistance through virtual applications or immediate family in cases of uncertainty. For improved accessibility, universal design principles and introducing co-design sessions into the design process of medical devices is recommended. Participants mentioned that manufacturers can establish a mobile phone app for adjusting their medical devices, such as continuous glucose monitors, or that manufacturers can collaborate with accessibility specialists from mainstream mobile device manufacturers to design for accessibility out of the box. The findings were shared with participants during Diabetes Awareness Month and with members of the community, as well as with leading insulin device manufacturers in Canada in the fall of 2021. Beyond patient safety studies in review processes, future work will advocate for regulatory bodies to incorporate accessibility into regulatory frameworks and guidelines, using clear evidence to demonstrate the levels of accessibility of medical devices.