Diabetes Technology Guide

The Johns Hopkins Patient Guide to Diabetes
The Johns Hopkins Patient Guide to Diabetes
hopkinsdiabetesinfo.org

Providing a trusted and reliable resource based on the latest evidence that people with diabetes or interested in diabetes can use to live healthier lives.
Preface

The Johns Hopkins Patient Guide to Diabetes website (hopkinsdiabetesinfo.org) provides evidence-based educational resources for those affected by diabetes, as well as others interested in gaining knowledge for health optimization.

Essential components on the website include:

1. **About Diabetes**: Causes, types, risk factors, clinical and personal management.
2. **Living with Diabetes**: Routine and preventative for improved diabetes health.
3. **Complications**: Types and preventions
4. **Treatment**: Treatment types based on the type of diabetes.
5. **Helpful Tools**: Diabetes coping skills, including downloadable tools
6. **Ask the Expert**: Advice & tips from medical experts
7. **Videos**: From general knowledge to interactive hands-on learning
8. **Real Stories**: Sharing personal experiences of living with diabetes
9. **Nutrition and Lifestyle Blog**: written by expert dietitians and educators
10. **Podcasts**: special guest speakers on various topics related to diabetes

The rise in modern medical technology has transformed diabetes care. Insulin pumps and continuous glucose monitors facilitate diabetes prevention, treatment, and reduction in diabetes complications. Given the ever expanding number of devices available, this Diabetes Technology Guide was written by our diabetes editorial team to bring together complex and up-to-date information on the latest diabetes devices to one convenient location for clarity, comparison, and confidence in decision-making, and to serve as a resource that is easily downloadable from the website.

Yours in Health,

The Johns Hopkins Patient Guide to Diabetes Website team
Editorial Team

Angela Yang, BA
Editorial Assistant

Thomas N. Mitchell, BA
Manager

Jennifer E. Fairman, MA MPS CMI FAMI
Website Designer and Developer

Sudipa Sarkar, MD MSCI
Managing Editor

Rita R. Kalyani, MD MHS FACP
Editor-in-Chief and Founder

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Diabetes is a global health epidemic that affects more than 500 million people around the world and is projected to increase even more in the future.
Diabetes

[dīəˈbēdēz, dīəˈbēdis] noun

Type 1 Diabetes: A chronic autoimmune disease caused by mistaken recognition and destruction of islets of Langerhans - the only source of insulin in the body - leading eventually to absolute insulin deficiency.

Type 2 Diabetes: A chronic disease due to insulin resistance primarily in the muscles, liver, and fat tissue. The body initially produces more insulin in response but is no longer able to compensate over time - leading to relative insulin deficiency.

In all types of diabetes, blood glucose levels are too high at diagnosis, and can lead to an increased risk of short and long-term complications without appropriate treatment.
“The person with diabetes who knows most, lives the longest.”

Elliot Joslin
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DISCOVERY OF INSULIN (1921)

After their 1921 discovery, Banting & Macleod shared the 1923 Nobel Prize in Physiology or Medicine.

INVENTION OF FIRST INSULIN PUMP (1963)

Backpack-style prototype developed by Dr. Arnold Kadish.

INTRODUCTION OF FIRST COMMERCIAL INSULIN PUMP (1979)

SOOIL insulin pump undergoes clinical evaluation.

INTRODUCTION OF EXTERNAL SMART PUMPS (1990s)

Development of hand-sized external, functional pumps with novel “smart” features (i.e. bolus calculator & alarm setting).

FIRST HYBRID CLOSED-LOOP SYSTEM (2016)

First FDA approved hybrid closed loop pump (Medtronic 670G).

FIRST DIY-APS (2015)

Individually-built artificial pancreas system that is do-it-yourself at home (not FDA-approved).

CGM NOT NEEDING FINGERSTICK CALIBRATION (2017, 2018)

Abbott Freestyle Libre Flash and Dexcom G6 were first CGMs to be FDA approved that no longer require fingerstick calibration.
Prevalence

>37.3 million

diagnosed and undiagnosed cases among adults ≥18 years old.

Types

Type 1 Diabetes: 5–10% (of all diagnosed diabetes cases)
Type 2 Diabetes: 90–95% (of all diagnosed diabetes cases)

1 in 3: have pre-diabetes
1 in 5: unknown about having diabetes

1 in 10: have diabetes

Race/Ethnicity

Non-Hispanic Whites 7.6%
Asian Americans 9%
Hispanics 12.8%
African Americans 13.2%
American Indians/Alaska Natives 15.9%

Burden

$13,700
estimated average medical spending annually per person diagnosed with diabetes in the US.

$327 Billion
loss of medical cost, work productivity, labor.

Diabetes Complications

Nerve Damage
Limb Problems
Poor Vision
Heart Disease
Kidney Failure
Stroke

What’s inside a typical diabetes bag

References:
Insulin Pump
I've been hearing some great things about diabetes technology, such as insulin pumps. May I ask what the benefits are from using this device?

Here are some upsides:
1. Consistent, adjustable insulin delivery (both basal & bolus)
2. Fewer manual insulin injections
3. Flexibility and privacy
4. Improved blood sugar levels.

Thanks! That's really interesting. Anything I should take into consideration?

Great question! Here are some downsides:
1. Cost: Device & additional supplies
2. Infusion-site infection
3. User compatibility: motivation, persistence, competence, teamwork, training

Delivers doses of insulin on a pre-programmed schedule through small, computerized devices

Both Type 1 and Type 2 persons with diabetes can use insulin pumps. Manual injections and insulin pump therapy work very differently. One-on-one training is a crucial part of insulin pump therapy.
CareLink
Personal Software:
upload data to software for creating and sharing reports

SmartGuard
Auto Mode:
Designed to reduce hypoglycemia & hyperglycemia

Blood Sugar Readings:
View from pump display & MiniMed CGM App

MiniMed 770G

hopkinsdiabetesinfo.org page 15
Key Features

- Programmed to change insulin basal setting every 5 mins that match to current glucose level
- SmartGuard Auto Mode intended for reducing hypoglycemic/hyperglycemic events
- Blood sugar readings can be viewed from pump display & smartphones with MiniMed CGM App (with Bluetooth connection)
- CareLink Personal Software: upload data from pump to software to create reports & share data with healthcare providers for enhanced patient-centered care & treatment.

CGM/BG

- CGM:
  - Guardian Link 3 Transmitter
  - Duration: ≤7 days

- BG Meter:
  - Accu-Chek Guide Blood Glucose Meter

Bolus/Basal

- Bolus:
  - Range: 0-25 units
  - Standard: 1.5 units/min
  - Quick: 15 units/min
  - Increments: 0.025 unit, 0.05 unit, 0.1 unit

- Basal:
  - 0-25 units/hr or set to max basal rate.

Infusion

- Medtronic Infusion Set: 4 types
  - Mio/Advance
  - Silhouette
  - Sure-T
  - Quick-set

Specifications

- Pump:
  - 2.1 x 3.78 x 0.96 inches (5.3 x 9.6 x 2.4 cm)
  - Wt: 3 oz (85 g)
  - 300-unit reservoir
  - Battery: AA (1); lithium/alkaline/ NiMH (FR6)
  - Waterproof:
    - 12 ft (3.6m) ≤ 12 hrs
    - Sensor/Transmitter: 8 ft (2.4m) < 30 mins

Notes

- Approved for T1Ds ≥ 2 yrs old.
- CareLink Personal software (downloadable on Windows & Mac)
- Compatible with MiniMed Mobile App via Bluetooth connection
- Warranty:
  - Pump: 4 yrs
  - CGM: 1 yr
Insulin delivery:
Insulin stoppable 30 mins before potential hyperglycemia & restarted when blood glucose back within optimal range.

Hybrid closed-loop system
wireless communication between insulin pump & CGM

SmartGuide Feature:
Monitors CGM blood glucose readings & bolus action to adjust basal insulin dosage.

MiniMed 670G
**Key Features**

- Hybrid closed-loop pump with wireless communication between insulin pump & CGM
- SmartGuide feature: Monitors CGM blood glucose readings & bolus action to adjust basal insulin dosage.
- Insulin administration can be stopped 30 mins before potential hyperglycemic episode & restarted when blood glucose back within optimal range.

**CGM/BG**

- BG Meter: Contour Next Link
- 2.4 Meter (wireless connection)

**Bolus & Basal**

- **Bolus Range:** 0.025-25 units
- **Basal Range:** 0.025-35 units/hr
- **Increments:**
  - 0.025 units
  - 0.05 units
  - 0.1 units

- **Insulin-to-Carb:** Fraction grams available

**Infusion**

- Medtronic Infusion Set: 4 types
  - Mio/Advance
  - Silhouette
  - Sure-T
  - Quick-set

**Specifications**

- **Pump:**
  - 1.4 x 1.12 x 0.37” (3.6 x 2.8 x 0.94 cm)
  - Wt: 0.19 oz (5.4g) w/o sensor
- **Transmitter:**
  - rechargeable
  - Charger: AAA battery (1)
- **Waterproof:** 8ft (2.4m) ≤ 30 mins
- **Receiver:**
  - 2.1 x 3.78 x 0.96 in (5.3 x 9.6 x 2.4 cm)
  - 3.7 oz (105g) without battery & unfilled reservoir

**MiniMed 670G**

- **Basal Range:** 0.025-35 units/hr
- **Increments:**
  - 0.025 units
  - 0.05 units
  - 0.1 units

**Notes**

- Approved for T1Ds ages ≥ 7 yrs old.
- CareLink Personal software (downloadable on Windows & Mac)
- Not compatible with MiniMed Mobile App
- Warranty: 4 yrs (pump) & 1yr (CGM)
- Manual pre-meal calculation & dosing still strongly recommended.

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Active Insulin

400 350 300 250 200 150 100 50

SmartGuard:
Responds to hypoglycemia-related events by stopping insulin delivery for ≤ 2 hrs.

No response to hypoglycemia alarm

MiniMed 630G

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**Key Features**

- Built-in CGM & SmartGuard feature.
- SmartGuard: Responds to hypoglycemia-related events by stopping insulin delivery for \( \leq 2 \) hrs:
- Blood sugar lower than personalized low range
- No response to hypoglycemia

**CGM/BG**

- Pump functions both as insulin pump & CGM.
  - CGM:
    - Guardian Sensor 3 built-in. (duration: \( \leq 7 \) days)
  - BG Meter:
    - Contour Next Link 2.4 Meter (wireless communication)

**Specifications**

- Pump:
  - 2.1 x 3.78 x 0.96 in
  - (5.3 x 9.6 x 2.4 cm)
  - \( \sim 3.7 \) oz (105g)
- 300-unit reservoir
- Battery: AA (1); Lithium/alkaline/NiMH
- Waterproof: 12 ft (3.6m) \( \leq 24 \) hrs

**Bolus/Basal**

- Bolus Range:
  - 0-26 units
- Default amt:
  - 10 units
- Basal:
  - 0-35 units/hr
- Increments:
  - 0.025 units/hr: \( \leq 0.975 \) units/hr
  - 0.05 units/hr: \( \leq 9.95 \) units/hr
  - 1 unit/hr: \( \geq 10 \) units/hr

**Infusion**

- Medtronic Infusion Set: 4 types
  - Mio/Advance
  - Silhouette
  - Sure-T
  - Quick-set

**Notes**

- T1Ds ages \( \geq 14 \) yrs old
- T1Ds ages \( \geq 16 \) yrs old
- CareLink Personal software (downloadable on Windows & Mac)
- Warranty: 4 yrs (pump) & 1 yr (CGM)
Summary

770G
- First Medtronic hybrid closed-loop insulin pump system that allows caregivers to directly adjust insulin delivery settings through Bluetooth.
- Designed to reduce hypoglycemic & hyperglycemic event: background insulin setting is automatically fine-tuned every five minutes based on real-time CGM blood sugar readings.
- Compatible with MiniMed Mobile App via Bluetooth connection
- Waterproof: 12 ft (3.6m) ≤ 12 hrs
- Approved for T1Ds ages ≥ 2 yrs old.

670G
- Two major upgraded features of 670G from 630G focus on enhancing hypoglycemic & hyperglycemic prevention:
  - Background insulin delivery setting automatically fine-tunes every five minutes based on real-time CGM blood sugar readings.
  - SmartGuide algorithm set to stop background insulin delivery 30 mins before potential hypoglycemic episode and restart when blood glucose returns back to the optimal range.
- Waterproof: 8 ft (2.4m) ≤ 30 min
- Approved for T1Ds ages ≥ 7 yrs old.

630G
- A non-hybrid closed loop insulin pump system that communicates with CGM for detecting and responding to real-time hypoglycemia
- Stops insulin delivery for ≤ 2 hrs.
- Waterproof: 12 ft (3.6m) ≤ 24 hrs
- T1Ds ages ≥ 14 yrs old.
Hybrid Close-Loop System: Control IQ and Dexcom G6 CGM.

Control IQ:
Basal insulin settings match to anticipated blood sugar 30 mins from current time.

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Key Features

- Hybrid closed-loop system: pump & Dexcom G6 CGM together enable Control IQ technology.
- Control IQ feature: Basal insulin settings match to anticipated blood sugar 30 mins from current time.
- For glucose level expected to rise ≥180 mg/dL, correction bolus initiated (nearly 60% of regular correction setting), for ≥160 mg/dl, higher basal is given, while glucose level expected to drop ≤112.5 mg/dL basal setting is lowered.

Specifications

- Pump:
  - 3.13 x 2 x 0.6 in (8 x 5.1 x 1.5 cm)
  - Wt: 3.95 oz (112g) (with battery & full reservoir
- 300-unit cartridge
- Battery: Rechargeable
- Waterproof: 3ft (0.91m) ≤ 30 min.

Bolus/Basal

- Max bolus range: 0.05-25 units
- Insulin-to-Carb: Fraction grams available
- Basal range: 0.1-15 units/hr
- Increment: 0.001 unit only

CGM/BG

- CGM:
  - Dexcom G6
  - (duration: 10 days)

Infusion

- Tandem infusion set: 3 different types
  - Autosoft 30/90/XC
  - Trusteel
  - Varisoft

Notes

- Approved for ages ≥14 yrs old.
- T.connect Diabetes Management
- Compatible Software: Tidepool & Glooko
- Control IQ does not replace pre-meal bolus.
- Pump updates completed via computer only for in-warranty pumps.
Hybrid Close-Loop System: Basal IQ and Dexcom G6 CGM

Basal-IQ feature:
Designed to stop insulin delivery in either real-time hypoglycemia or downward trend towards hypoglycemia with pump-CGM connection.

Insulin delivery resumes following blood sugar returning to normal level.
Key Features

- Basal-IQ feature: Designed to stop insulin delivery in either of these hypoglycemic-related episodes with pump- CGM connection:
  - Blood sugar reading showing ≤ 70mg/dL
  - Downward trend of reaching ≤ 80mg/dL within 30 mins
- Insulin delivery resumes following blood sugar returning to normal level.

CGM/BG

CGM:
Dexcom G6
(duration: 10 days)

Specifications

Pump:
3.13 x 2 x 0.6 in
(8 x 5.1 x 1.5 cm)
3.95 oz (112g) with battery & full reservoir
300-unit cartridge
Battery: Rechargeable
Waterproof: 3ft (0.91m) ≤ 30 mins.

Bolus/Basal

Bolus Range:
0.05–25 units
Max amt:
Add’l 25 units
Insulin-to-Carb:
Fraction grams available
Basal Range:
0.1–15 units/hr
Increment:
0.001 unit only

Infusion

Tandem infusion set: 3 different types
- Autosoft 30/90/XC
- Trusteel
- Varisoft

Notes

- Approved for ages ≥ 6 yrs old.
- T:connect Diabetes Management
- Compatible with:
  - Tidepool
  - Glooko

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Control IQ

- First Tandem hybrid closed-loop system.
- Control IQ feature: Automated adjustments in basal insulin settings (cessation/correction bolus) that matches to anticipated blood sugar 30 mins from current time.
- Assesses glucose trends in order to adjust basal rates.
- Control IQ does not replace pre-meal bolus.
- Approved for ages ≥ 14 yrs old.

Basal IQ

- Non-hybrid closed loop system that responds to real-time or anticipated hypoglycemic-related episodes with automatic cessation of insulin delivery.
- Insulin administration resumes following blood sugar returning to normal level.
- Approved for ages ≥ 6 yrs old.
Hybrid closed-loop system: Pump & Dexcom G6 CGM

HypoProtect:
Automatic cessation for hypoglycemia with max limit at 150 mg/dL; lowering of basal insulin delivery for exercise.

SmartAdjust:
Live basal adjustments every 5 mins, dependent on current/predicted glucose trends from CGM, IOB, insulin sensitivity factors, and HypoProtect; better personalized basal accuracy after 2-3 pods of use, or ~9 days.
Key Features

- Hybrid closed-loop system: pump & Dexcom G6 CGM together enable Automated Insulin Delivery System.
- Automated Insulin Delivery System (AID): The SmartAdjust technology controlled with Omnipod 5 controller or with mobile app.
- SmartAdjust: live basal adjustments every 5 mins, dependent on current/predicted glucose trends from CGM, IOB, insulin sensitivity factors, and HypoProtect; better personalized basal accuracy after 2-3 pods of use, or ~9 days.
- Glucose targets: Adjustable and customizable (quantity/time) in 10mg/dL increments (110-150 mg/dL).
- HypoProtect: automatic cessation for hypoglycemia, max limit at 150 mg/dL; lowering of basal insulin delivery for exercise.
- SmartBolus Calculator
- Omnipod 5 App: View real-time BG data, insulin delivery, alerts & reminders.

Specifications

| Pod | 1.53 x 2.05 x 0.57 in (3.9 x 5.2 x 1.4 cm) |
| Wt: 1.2 oz (34g) (with full reservoir); battery included |
| Insulin delivery via cannula attached to pod |

| Controller | Battery: Rechargeable |
| Watertight: 25ft (7.6m) ≤ 60 mins |

| Bolus/Basal |
| Bolus Range: N/A |
| Increments: N/A |
| Insulin-to-Carb N/A |
| Increments: N/A |

Infusion

- No infusion set needed

Notes

- Approved for T1Ds ages ≥ 6 yrs old.
- SmartAdjust does not replace pre-meal bolus.
PDM:
Functions as Freestyle blood sugar meter. Carries nutrition info of ≥ 1,000 foods & ≤ 36 personalized easy-to-reach carb info.

Pod:
Tubeless & wireless pod & Personal Diabetes Manager (PDM) & Contour Next One.

Omnipod Dash
Key Features
- Tubeless & wireless insulin pump, controlled with Personal Diabetes Manager (PDM).
- Color touch screen PDM for viewing blood sugar data & insulin delivery.
- Contour Next One: Delivers blood glucose data to PDM wirelessly, can be viewed from PDM & selected smartphone devices with Omnipod Display app.
- PDM: Programmed with Calorie King food library (≥ 80,000 foods/drinks & ≤ 50 personalized, easy-to-reach carb info)

Specifications
Pod:
1.53 x 2.05 x 0.57 in
(3.9 x 5.2 x 1.4 cm)
Wt: 1.2 oz (34g) (with full reservoir); battery included
200-unit built-in reservoir

PDM:
3.7 oz (106g)
Battery: rechargeable
Watertight: 25ft (7.6m) ≤ 60 mins

Pod:
3-day use

BG Meter: Contour Next One Blood Glucose Meter

CGM/BG
Pod:
3-day use

CGM: none

BG Meter: Contour Next One Blood Glucose Meter

Bolus & Basal
Bolus Range:
0.05-30 units

Increments:
• 0.05 units
• 0.1 units
• 0.5 units
• 1 unit

Insulin-to-Carb:
0.1 unit

Optional zero basal rate setting

0.05-30 units/hr

Increments:
0.05 units

Infusion
No infusion set needed
Insulin delivery via cannula attached to pod

Notes
- Approved for ages ≥ 2 yrs old.
- Requires PDM to be ≤ 5 ft from pod for successful bolus delivery. (not applicable for basal)
- Compatible Software:
  - Tidepool
  - Glooko
- Apps:
  - Omnipod Display (for self-management)
  - Omnipod Vie (for ≤ 12 caregivers)
- Warranty: ≤ 4 yrs for PDM from purchase date
Tubeless & wireless insulin pump (3-day use), with Personal Diabetes Manager (PDM)

PDM: Functions as Freestyle blood sugar meter. Carries nutrition info of ≥ 1,000 foods & ≤ 36 personalized easy-to-reach carb info.
### Key Features
- First tubeless & wireless insulin pump.
- Consists of pod (lasting ≤ 72 hrs) & Personal Diabetes Manager (PDM) which also functions as Freestyle blood sugar meter.
- PDM: Carries nutrition info of ≥ 1,000 foods & ≤ 36 personalized easy-to-reach carb info.

### Specifications

<table>
<thead>
<tr>
<th>Pod</th>
<th>1.53 x 2.05 x 0.57 in (3.9 x 5.2 x 1.4cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (with full reservoir)</td>
<td>1.2 oz (34g)</td>
</tr>
<tr>
<td>Watertight</td>
<td>25ft (7.6m) ≤ 60 min</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PDM</th>
<th>2.4 x 4.4 x 0.82 in (6.1 x 11 x 2.1 cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (with batteries)</td>
<td>4.4 oz (125g)</td>
</tr>
<tr>
<td>Battery</td>
<td>AAA (2); Alkaline</td>
</tr>
</tbody>
</table>

### CGM/BG
- PDM functions as both wireless insulin pump & blood glucose meter
- CGM: none
- BG Meter: FreeStyle Blood Glucose Meter
- Pod: (duration: ≤ 3 days)

### Bolus & Basal
- **Bolus Range:** 0.05-30 units
  - **Increments:**
    - 0.05 units
    - 0.1 units
    - 0.5 units
    - 1 unit
- **Insulin-to-Carb:** Only whole unit increments available
  - 0.05-30 units/hr
  - **Increments:** 0.05 units

### Infusion
- No infusion set needed
- Insulin delivery with cannula attached to pod with PDM connection

### Notes
- FDA-approved for all ages.
- Requires PDM to be ≤ 5 ft from pod for successful bolus delivery. (not applicable for basal)
- Nightlight port for test-strip, food dictionary, bolus calculator/ changes (also for basal), setting reminders/alerts.
- Compatible Software:
  - Tidepool
  - Glooko
- Warranty: ≤ 4 yrs for PDM from purchase date
### Summary

<table>
<thead>
<tr>
<th>Omnipod 5</th>
<th>Omnipod Dash</th>
<th>Omnipod System</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Omnipod hybrid closed-loop system: Pump &amp; Dexcom G6 CGM.</td>
<td>Second generation Omnipod system</td>
<td>First generation Omnipod system</td>
</tr>
<tr>
<td>Automated Insulin Delivery System (AID): The SmartAdjust technology controlled w/ Omnipod 5 PDM/Receiver or with mobile app.</td>
<td>Upgraded PDM (the receiver): Color touchscreen</td>
<td>PDM Controller: viewing blood sugar data &amp; insulin delivery.</td>
</tr>
<tr>
<td>SmartAdjust: Live basal adjustments every 5 mins, dependent on current/predicted glucose trends from several indicators; does not replace pre-meal bolus.</td>
<td>Includes Contour Next One, an external blood glucose meter, from PDM system.</td>
<td>pre-programmed basal settings and bolus calculations</td>
</tr>
<tr>
<td>Better personalized basal accuracy after 2–3 pods of use, or ~9 days.</td>
<td>Delivers blood glucose data to PDM wirelessly, viewable from PDM &amp; with Omnipod Display app.</td>
<td>FDA-approved for children &amp; adults</td>
</tr>
<tr>
<td>HypoProtect: automatic cessation for hypoglycemia, max limit at 150 mg/dL; lowering of basal insulin delivery for exercise.</td>
<td>Approved for ages ≥ 2 yrs old.</td>
<td></td>
</tr>
<tr>
<td>Approved for T1Ds ages ≥ 6 yrs old.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Page 36 © The Johns Hopkins University
Hassle-free & pre-filled insulin cartridge: programmed to deliver customized bolus (even simultaneously for different settings) & basal.
Key Features

- First tubeless & wireless insulin pump.
- Consists of pod (lasting ≤ 72 hrs) & Personal Diabetes Manager (PDM) which also functions as Freestyle blood sugar meter. 
- PDM: Carries nutrition info of ≥ 1,000 foods & ≤ 36 personalized easy-to-reach carb info.

Specifications

Pod:
1.53 x 2.05 x 0.57 in (3.9 x 5.2 x 1.4 cm)
Wt: 1.2 oz (34g) (with full reservoir); battery included
200-unit built-in reservoir
Watertight: 25ft (7.6m) ≤ 60 min

PDM:
2.4 x 4.4 x 0.82 in (6.1 x 11 x 2.1 cm)
Wt: 4.4 oz (125g) (with batteries)
Battery: AAA (2); Alkaline

BG Meter:
FreeStyle Blood Glucose Meter

Pod:
(duration: ≤ 3 days)

Bolus & Basal

Bolus Range:
0.05-30 units

Increments:
• 0.05 units
• 0.1 units
• 0.5 units
• 1 unit

Insulin-to-Carb:
Only whole unit increments available

0.05-30 units/hr

Increments:
0.05 units

Infusion

No infusion set needed
Insulin delivery with cannula attached to pod with PDM connection

Notes

- FDA-approved for all ages.
- Requires PDM to be ≤ 5 ft from pod for successful bolus delivery. (not applicable for basal)
- Nightlight port for test-strip, food dictionary, bolus calculator/ changes (also for basal), setting reminders/alerts.
- Compatible Software:
  • Tidepool
  • Glooko
- Warranty: ≤ 4 yrs for PDM from purchase date

CGM/BG

PDM functions as both wireless insulin pump & blood glucose meter

CGM: none

BG Meter:
FreeStyle Blood Glucose Meter

Aviva Insight
<table>
<thead>
<tr>
<th>Time of test</th>
<th>Carbohydrates</th>
<th>Health events</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before meal</td>
<td>30g</td>
<td>Exercise</td>
<td></td>
</tr>
</tbody>
</table>

120 mg/dL
6:30, 24 Mar 2021
Key Features

- Tubeless, detachable micropump with touchscreen
- PDM integrated with blood glucose meter for optimal dosing and delivery of insulin.
- Customizable notifications and alarms.
- Can be used interchangeably with MDI without data loss.

CGM/BG

PDM functions as both wireless insulin pump & blood glucose meter

CGM: compatibility for some

MicroPump:
(duration: ≤ 4 days)

Specifications

Pump:
2.4 x 1.5 x 0.51 in
(6.1 x 3.8 x 1.3 cm)
Wt: <29g (with full reservoir)

Battery: 1.4V zinc-air
80–200 units of insulin

PDM:
12.4 x 6.4 x 1.7 cm
Wt: 140g

Notes

FDA-approved
1.5 meters between devices

Aviva Solo

Bolus & Basal

Bolus Range:
0.2–50 units

Types:
- Standard bolus
- Quick bolus
- Extended bolus
- Multiwave bolus

*Time extension for extended bolus & multiwave bolus adjustable every 15 min for ≤ 24 hrs.

Increments:
- • 0.05 units
- • 0.1 units
- • 0.2 units
- • 1.0 unit

Quick bolus
- • 0.2 units
- • 0.5 units
- • 1.0 units
- • 2.0 units

Basal:
0.1–25.0 units/hr

5 customizable profiles

Increments:
- • 0.01 units
- • 0.1 units

Temporary Basal Rate:
0–90% & 110–250%: increments of 10% and adjustable every 15 mins ≤ 24 hrs. 5 is max TBRs.

Infusion

2 cannulas: different length and insertion depth
- • Orange: 6mm
- • Blue: 9 mm

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Key Features

- Simplistically designed pump device with icon display delivering insulin, both bolus & basal.

Specifications

- Pump:
  - 2.95 x 1.77 x 0.74 in
  - (7.5 x 4.5 x 1.9 cm)
  - Wt: 2.15 oz (61g)
  - 300-unit reservoir
  - Battery: 3.6-volt DC lithium (1)
  - Waterproof: 3.3 ft (1m) ≤ 1 hr

- Bolus & Basal
  - Bolus Range:
    - 0.1-80 units
  - Increments:
    - 0.1 units
    - 0.5 units
    - 1 unit
  - 0.04-16 units/hr
  - Increments:
    - 0.01 units
    - 0.1 units

Infusion

- Infusion set: 3 different types
  - Soft Release O/ST
  - Easy Release I/II
  - Superline-ST

Notes

- Approved for T1Ds ages ≥ 7 yrs old.
- Compatible App: DiabecareDana-I
- Warranty: 4 yrs
3.5-day use
Fast occlusion detection even at lowest infusion speed

EOPatch
Key Features

- 3.5-day use (84 hrs)
- Fast occlusion detection even at lowest infusion speed
- Notification for secure insertion
- Insertion speed painless and soft cannula

CGM/BG

- Patch: 3.5 days
- CGM:

Specifications

Patch:
- 49.5x39x14.5mm
- 12 mos shelf life
- 200-unit reservoir; 80 unit min

Battery:
- 3.7V, 1,130 mAh

Controller:
- 116.5x64.5x114 (mm)
- 110g with battery
- Korean/English

Waterproof:
- IPx8 (1m) ≤ 24hrs

Bolus & Basal

- 8 bolus and basal programs

Infusion

- Soft cannula: insertion depth: 4.75mm (vertical)

Notes

- Narsha: smartphone app EOBridge software
Simplistic design for efficient insulin delivery and blood glucose monitoring.

Yposopump

Compatible with Dexcom G6
Specifications

Pump:
7.8x4.6x1.6cm
83g (including battery & filled cartridge)
Pre-filled/self-filled single-use insulin cartridge:
1.6ml/160 units

Battery:
Battery: 1.5 V alkaline (LR03), AAA;
avg 30-day use (54 U/day)

Controller:
OLED touchscreen, 4.1x1.6cm

Waterproof:
IPX8 according to EN 60529 (immersion to depth of 1 m for up to 60 mins).

Key Features

- Compatible with Dexcom G6
- Empty reservoir filled with Prefilled insulin cartridge
- Refilled insulin: 16ml (160u)
- Bluetooth connection

CGM/BG
Reservoir:
1.6ml (160 units)
100 U/ml, rapid-acting insulin analogue.
- Fiasp
- NovoRapid
- Humalog
- Apidra
- Insulin lispro Sanofi

Bolus & Basal

Mylife YpsoPump Orbit infusion set with mylife Orbit Inserter

Range: 0-40 units/hr

2 personalized programs: A & B.

Temporary basal rate available

- Increments:
  - 0.01 (≤1.00u/hr)
  - 0.02 (≤2.00u/hr)
  - 0.1 (≤15.0u/hr)
  - 0.5 (≤40.0u/hr)

CGM/BG

Fiasp
NovoRapid
Humalog
Apidra
Insulin lispro Sanofi

Infusion

Bolus Types:
- Standard
- Extended
- Combination
- Blind bolus
- Stacked bolus

Bolus Range:
0.1 - 30 units

Increments:
- 0.1u
- 0.5u
- 1.0u
- 2.0u

Notes

Compatible App:
- mylife Assist
- mylife App

Mylife Software
Incompatible with any software/meters/CGMs.

Delivers bolus by pressing button instead of electronic signaling.
Key Features

- Non-electric, manually functioning, insulin patch that delivers bolus incrementally with a push of a button.
  - Patch: replaced daily, cost-saving, co-pay card available.
  - Basal rate: Preset & administered with needle instead of attached tube.
  - Incompatible with any software/meters/CGMs.

Specifications

- Pump:
  2.4 x 1.3 x 0.5 in
  (6.1 x 3.3 x 1.3 cm)
  Wt: 0.7-1.8 oz (20-51g) (with full cartridge)

- Battery: None required

- Reservoir types:
  - V-Go 20: 56 units
  - V-Go 30: 66 units
  - V-Go 40: 76 units

Bolus & Basal

- V-Go 20: 36 units
- V-Go 30: 66 units
- V-Go 40: 76 units

- Increments:
  - 2 units only

- V-Go 20: 20 units in 1 day
- V-Go 30: 30 units in 1 day
- V-Go 40: 40 units used in 1 day

CGM/BG

- None

Notes

- Approved for T1D & T2D adults

Infusion

- Tubeless, built-in stainless-steel needle

V-Go

hopkinsdiabetesinfo.org
Continuous Glucose Monitor
Continuous glucose monitors (CGMs) are devices that monitor blood glucose every few minutes, display past, current, and predicted blood glucose frequently throughout the day.

People with both Type 1 and Type 2 diabetes can use continuous glucose monitors. Most often, these devices are compatible with Apple/Android phones for convenient blood glucose view.
Guardian Connect App:
View real-time glucose data; customizable alert with fully integrated Medtronic devices.

Readings: BG updated every 5 mins.
Key Features

- Designed for 7-day use with Guardian sensor and transmitter
- Readings: BG updated every 5 mins
- Alerts: Personalized & preset alerts prior to hypoglycemia & hyperglycemia episode. (Urgent low [55mg/dL] alarm always on.)
- Tracking markers: insulin delivery, meal, exercise
- Guardian Connect app: View real-time glucose data; customizable alerts

Specifications

Real Time CGM

- Sensor Life: ≤ 7 days
- Transmitter: 1.41 x 1.13 x 0.38 in (3.58 x 2.9 x 0.97 cm) 0.04 oz (1.13g) with sensor; rechargeable
- Battery: AAA (1) (charger)
- Waterproof: 8 ft ≤ 30 mins

Apps/Software

- Guardian Connect App (Apple & Android devices)
- Sugar.IQ App
- CareLink Software (for most Windows/Mac)

Connection/Calibration

- Transmitter must be ≤ 20 ft from smartphone device
- When dosing insulin, glucose reading must be confirmed with fingerstick reading.
- Calibration every 12 hrs

Notes

- 670G: Approved for children & adults ≥ 7 yrs old
- Guardian Connect System: Approved for children & adults ≥ 14 yrs old.
- Acetaminophen may change accuracy of blood glucose readings.
- Compatible with Apple Watch.
Dexcom G6

CGM Data:
Can be sent to selected smartphone devices with Dexcom G6 App downloaded. Share feature allows glucose data to be shared with ≤ 10 followers (e.g., parents, etc) for remote monitoring.

Designed for 10-day non-adjustive use & compatible with Tandem pumps.

G6 vs. G5: G6 doesn’t require calibration, has longer wear time, & is slimmer in size for transmitter & larger for receiver.
**Key Features**

- Designed for 10-day non-adjustive use & compatible with Tandem pumps.
- G6 vs. G5: G6 does not require calibration, has longer wear time, & is slimmer in size for transmitter & larger for receiver.
- Alerts: Personalized alerts for hypoglycemia & hyperglycemia episodes / trends. (Urgent low [55mg/dL] alarm always on.)
- CGM Data: Can be sent to selected smartphone devices with Dexcom G6 App downloaded. Share feature allows glucose data to be shared with <= 10 followers (e.g., parents, etc) for remote monitoring.

**Notes**

- Approved for children & adults ≥ 2 yrs old.
- Glucose readings not affected by taking acetaminophen 1000 mg every ≤ 6hrs.
- Compatible with Tandem pumps & Apple Watch.

**Apps/Software**

- Dexcom Clarity App
- Dexcom Follow App (some Apple/Android devices, Tandem t:slim X2 pump): ≤ 10 people viewing current glucose level
- Glooko
- Tidepool

---

**Connection/Calibration**

- Receiver or smartphone with Dexcom app must be ≤ 20 ft from transmitter & sensor.
- 2 hrs after sensor setup
- No calibration

**Specifications**

**Real Time CGM**

- Sensor Life: 10 days

**Transmitter:**

- 1.68 x 0.86 x 0.33 in
- (4.23 x 2.18 x 0.84 cm)
- Wt: 0.42 oz (11.91g) (with sensor; built-in battery lasting ~3 mos.)

- Waterproof: 8 ft ≤ 24 hrs

**Receiver:**

- 4.02 x 2.44 x 0.46 in
- (10.21 x 6.2 x 1.17 cm)
- Wt: 3.3 oz (93.6g)

- Battery: rechargeable

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hopkinsdiabetesinfo.org
Designed for non-adjustive use (7-day) & compatible with Tandem pumps.

Dexcom G5 App:
CGM data & alerts transferrable

Dexcom G5

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**Key Features**

- Designed for non-adjustive use (7-day) & compatible with Tandem pumps.
- G5 vs. G6: Compared to Dexcom G6, Dexcom G5 transmitter thicker but slightly smaller in size.
- Alerts: Personalized alerts for hypoglycemia & hyperglycemia episode / trend (Urgent low [55mg/dL] alarm always on.)
- Dexcom G5 App: CGM data & alerts transferable
- Dexcom Follow App: Glucose data shareable with ≤5 followers (e.g. parents) for remote monitoring

**Specifications**

**Real Time CGM**

**Sensor Life:** 7 days

**Transmitter:**
- 1.52 x 0.88 x 0.47 in
- (3.86 x 2.24 x 1.19 cm)
- 0.4 oz (11.3g) with sensor; built-in battery lasting ~ 3 mos

**Waterproof:** 8 ft ≤ 24 hrs

**Receiver:**
- 4 x 1.8 x 0.5 in
- (10.2 x 4.6 x 1.3 cm)
- 2.4 oz (68g)

**Battery:** rechargeable

**Connection/Calibration**

- Receiver/smartphone with Dexcom app must be ≤ 20 ft from transmitter & sensor.
- 2 hrs after sensor setup
- Finger-stick reading not required
- Calibration every 12 hrs: manual input required
- BG reading range: 40–400 mg/dL.

**Apps/Software**

- Dexcom Clarity App
- Dexcom Follow App (some Apple/Android devices): ≤ 5 people viewing current glucose level
- Glooko
- Tidepool

**Notes**

- Approved for children & adults ≥ 2 yrs old.
- Acetaminophen may change accuracy of blood glucose readings
- Compatible with Tandem pumps & Apple Watch
14 days Sat Feb 9, 2019 - Fri Feb 22, 2019

Avg. Glucose mg/dL
Very Low: < 54 mg/dL
Low: < 70 mg/dL
In Target Range: 70-180 mg/dL
High: > 180 mg/dL
Very High: > 250 mg/dL

Coefficient of Variation SD mg/dL
% Time CGM Active

Cgm <54 mg/dL <70 mg/dL 70-180 mg/dL >180 mg/dL >250 mg/dL

Glucose Ranges Glucose Exposure
Glucose Statistics Glucose Variability

Curves/plots represent glucose frequency distributions by time regardless of date.

Ambulatory Glucose Profile Sat Feb 9, 2019 - Fri Feb 22, 2019 (14 days)
98%
Angela Yang
G6 CGM System

- 10-day use with optional calibration.

- Compared to G5, G6 does not require calibration, has longer wear time, & is slimmer in size for transmitter & larger for receiver.

- Dexcom Follow App shareable with ≤ 10 followers

G5 CGM System

- 7-day use with calibration recommended.

- Compared to Dexcom G6, Dexcom G5 transmitter is thicker but slightly smaller in size.

- Dexcom Follow App shareable with ≤ 5 followers.
FreeStyle Libre 2 App: Programmed as reader.

Readings: Manual scanning (receiver to sensor) required.

Designed for 14-day use with FreeStyle Libre 2 app.

Abbott
Key Features

- Designed for 14-day use with built-in FreeStyle blood sugar meter that shows glucose readings.
- Readings: manual scanning (receiver to sensor) required.
- Alerts: Alarms for hypoglycemia / hyperglycemia not built into device.

Connection/Calibration

- Reader must be ≤ 1.5 inches from sensor for scanning.
- 1 hr wait time following sensor setup & scanning.
- No calibration

Specifications

Flash CGM

Sensor Life: 14 days

Transmitter:
1.38 in (diameter) x 0.2 in
(3.5 cm x 0.51 cm)
0.18 oz (5.1 g)

Battery: silver oxide (1)

Waterproof: 3 ft ≤ 30 min

Receiver:
2.36 x 3.74 x 0.63 in
(6 x 9.5 x 1.6 cm)
2.3 oz (65.2 g)

Battery: lithium-ion rechargeable (1)

Apps/Software

- LibreView Software: ≤ 20 people for viewing (downloadable on Windows & Mac)
- FreeStyle LibreLink (for some Apple & Android devices)

Notes

- Approved for adults ≥ 18 yrs old.
- Glucose readings not affected by taking acetaminophen 1000 mg every ≤ 6 hrs.
Libre 14-Day

Designed for 14-day use with built-in FreeStyle blood sugar meter that shows glucose readings.

Readings: manual scanning (receiver to sensor) required.

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Key Features

- Designed for 14-day use with built-in FreeStyle blood sugar meter that shows glucose readings.
- Readings: manual scanning (receiver to sensor) required.
- Alerts: Alarms for hypoglycemia / hyperglycemia not built into device.

Connection/Calibration

- Reader must be ≤ 1.5 inches from sensor for scanning.
- 1 hr wait time following sensor setup & scanning
- No calibration

Specifications

Flash CGM
Sensor Life: 14 days

Transmitter:
1.38 in (diameter) x 0.2 in
(3.5cm x 0.51 cm)
0.18 oz (5.1g)
Battery: silver oxide (1)
Waterproof: 3 ft ≤ 30 min

Receiver:
2.36 x 3.74 x 0.63 in
(6 x 9.5 x 1.6 cm)
2.3 oz (65.2g)
Battery: lithium-ion rechargeable (1)

Apps/Software

- LibreView Software: ≤ 20 people for viewing (downloadable on Windows & Mac)
- FreeStyle LibreLink (for some Apple & Android devices)

Notes

- Approved for adults ≥ 18 yrs old.
- Glucose readings not affected by taking acetaminophen 1000 mg every ≤ 6hrs.
Freestyle Libre 14-Day System

- Designed for 14-day use with built-in FreeStyle blood sugar meter that shows glucose readings.
- Alarms for hypoglycemia / hyperglycemia not built into device.
- For adults and children ≥ 4 yrs old.

FreeStyle Libre 2

- Designed for 14-day use with FreeStyle Libre 2 App
- Alarms for hypoglycemia / hyperglycemia are built into device.
- FreeStyle Libre 2 App (iPhone only): Programmed as reader.
- For adults ≥ 18 yrs old.
February 2013 (14 days)

<table>
<thead>
<tr>
<th>Estimated A1c</th>
<th>6.2%</th>
<th>44</th>
</tr>
</thead>
</table>

**DAILY CARBS**
226 gms/day

**Insulin**

<table>
<thead>
<tr>
<th>RAPID-ACTING INSULIN</th>
<th>47.9 units/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meal</td>
<td>35.6u</td>
</tr>
<tr>
<td>Correction</td>
<td>3.6u</td>
</tr>
<tr>
<td>User Change</td>
<td>3.6u</td>
</tr>
<tr>
<td>Manual</td>
<td>0.5u</td>
</tr>
</tbody>
</table>

**LONG-ACTING INSULIN**
17.1 units/day

**Total Daily Insulin**
65.0 units/day

**Comments**
- There was a ketone test; the result was 1.4 mmol/L.
- Ratio of average correction insulin is 24:
- 9 user-changes of the suggested insulin.
Sensor (90-day use) surgically placed underneath skin in upper arm by trained healthcare provider.

Readings:
Removable transmitter is positioned externally on top of sensor which sends blood sugar readings to selected smartphone devices, updating every 5 mins.

Glucose Within Target Levels

<table>
<thead>
<tr>
<th>Time</th>
<th>Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>6PM</td>
<td>160 mg/dL</td>
</tr>
<tr>
<td>7PM</td>
<td>75 mg/dL</td>
</tr>
<tr>
<td>8PM</td>
<td>100 mg/dL</td>
</tr>
</tbody>
</table>

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### Key Features

- **Sensor (90-day use)** surgically placed underneath skin in upper arm by trained healthcare provider.
- **Readings:** Removable transmitter is positioned externally on top of sensor which sends blood sugar readings to selected smartphone devices, updating every 5 mins.
- **Alerts:** On-body active vibration alert for dynamic/anticipated hypoglycemia & hyperglycemia episodes even without smartphone device nearby.
- **Calibrations:** When administering bolus insulin, glucose reading must be confirmed with fingerstick reading & ≥ 2 calibrations/day required.

### Specifications

**Implantable CGM**
- **Sensor Life:** ≤ 90 days

**Transmitter:**
- 1.48 x 1.89 x 0.35 in (3.8 x 4.8 x 0.89 cm)
- 0.39 oz (11.1g)
- Battery: lithium polymer battery, rechargeable
- Waterproof
- No receiver needed

### Connection/Calibration

- Transmitter must be ≤ 25 ft from smartphone device.
- 24 hrs wait time after sensor setup
- When administering bolus insulin, glucose reading must be confirmed with fingerstick reading & ≥ 2 calibrations/day required.
- BG reading range: 40-400 mg/dL.

### Apps/Software

- **Eversense App:** ≤ 5 people viewing current glucose level (on Apple/Android devices)
- **Eversense Data Management System Software**
- **Glooko**

### Notes

- Approved for adults ≥ 18 yrs old.
- Approved for MRI scan.
- Glucose readings not affected by taking acetaminophen.
- Contraindicated in people for whom dexamethasone is not encouraged for use.