HEALTH PLANS
UNIVERSITY OF UTAH

Medical Policy

Ambulatory Insulin Pumps and Closed-Loop Insulin Delivery Systems

Policy MP-007

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Disclaimer:

1. Policies are subject to change in accordance with State and Federal notice requirements.
2. Policies outline coverage determinations for U of U Health Plans Commercial, CHIP and Healthy U (Medicaid) plans. Refer to the "Policy" section for more information.
3. Services requiring prior-authorization may not be covered, if prior-authorization is not obtained.
4. This Medical Policy does not guarantee coverage or payment of the service. The service must be a benefit in the member's plan and the member must be eligible for coverage at the time of service. Additional payment guidelines may be applied that are not included in this policy.

Description:

As of 2018, diabetes remained the 7th leading cause of death in the United States. There are an estimated 1.5 million new cases of Americans (age 18 and older) diagnosed with diabetes every year. The Center for Disease Control (CDC) reported in 2018 that the U.S. had approximately 26.9 million people (of all ages) or 8.2% of the population, diagnosed with diabetes. In that same year, an estimated 88 million people age 18 and older had prediabetes, of which 7.3 million were not aware of having it or they didn't report it.

Continuous subcutaneous insulin infusions (insulin pump therapy) have been used to treat diabetes since the late 1970's and are now available in several forms. The most common type is an external insulin infusion pump which is a programmable, battery-powered mechanical syringe/reservoir device controlled by a micro-computer to provide continuous subcutaneous insulin infusion (CSII) in individuals with diabetes mellitus. Typically, the syringe has a 2-3 day insulin capacity and is connected to an infusion set attached to a small needle or cannula which the individual inserts into the subcutaneous tissue. The syringe is activated by a battery operated pump programmed to deliver a steady "basal" amount of insulin and release a "bolus" dose at meals and at programmed intervals. The pump is about the size of a deck of cards, weighs about 3 ounces, and can be worn on a belt or in a pocket.

Closed-loop insulin delivery systems combine the technology of a continuous glucose monitor (CGM) and an insulin pump, these help eliminate the need for patients or providers to intervene in the management of blood sugar trends in real-time. These "closed-loop" systems

contain computer-controlled algorithms that connects the CGM and insulin infusion pump to allow continuous communication between the two devices. They allow people with diabetes to receive insulin through a pump continuously throughout the day and night based on glucose measurements provided every five minutes by the CGM.

Policy Statement and Criteria

1. Commercial Plans/CHIP

U of U Health Plans covers insulin pumps for all Type 1 diabetics, regardless of the adequacy of their current insulin regimen.

U of U Health Plans covers ambulatory insulin pumps for Type 2 diabetics if the following criteria are met:

A. <u>Insulin pump criteria:</u>

i. Diabetes members with at least one year of subcutaneous multidose insulin therapy.

ii. Documentation through log books of treatment regimen consisting of three or more injections of insulin per day including both long-acting insulin analogs (insulin glargine, insulin determir or insulin degludec) plus a short-acting insulin analog (insulin aspart, insulin lispro or insulin glulisine) for at least two months prior to initiation of insulin pump. Must have at least 80% compliance over two months.

iii. Has documented logs of glucose self-testing at least 4 times per day for two months prior to initiation of the insulin pump. Must have 80% compliance over two months.

iv. Documentation of members or caregivers ability to perform carbohydrate counting and insulin dose calculation.

v. Documentation of diabetes specialist's assessment of clinical therapeutic value of an insulin pump and ability to train member on appropriate use of insulin pump.

vi. Documentation of at least 2 visits with a diabetes specialist during the six months prior to initiation.

vii. Meets one or more of the following criteria while on a multiple daily injection insulin (a - e):

a. Glycosylated hemoglobin levels (HbA1c) greater than 8%;

b. Recent history (within the last six months) of significant, recurring hypoglycemia (less than 60mg per deciliter or requiring assistance);

c. Wide fluctuations (well above and below set glycemic targets) in blood glucose before and after meal times, despite appropriate adjustment of doses;

d. At least one documented incidence of hyperglycemic hyperosmotic syndrome or diabetic ketoacidosis within the previous six months;

B. Covered Products:

i. Medtronic

a. Minimed 530G

b. Minimed 630G

c. Minimed 670G – Hybrid closed-loop insulin delivery system

d. Minimed 770G

ii. Omnipod (Omnipod DASH and Omnipod 5 are NOT covered under the medical benefit but may be covered under the pharmacy benefit)

iii. Tandem Diabetes

a. t:flex

b. t:slim X2

iv. Pump systems eligible for supplies only, **NOT** new service

a. Animas Vibe

b. Animas One Touch Ping

c. Roche Accu-Chek Combo

C. Renewals:

i. Patients must have had at least 2 visits with a diabetes specialist within the previous 12 months.

ii. Documentation must show that the member is adhering to the treatment plan outlined by a diabetes specialist.

iii. Patients who are continuing insulin pump therapy and requesting a new insulin pump must provide documentation that current pump's warranty has expired.

D. Exemptions:

i. Patients with gestational diabetes or diabetes during pregnancy are exempted from previous management provisions of this policy.

U of U Health Plans may cover closed-loop insulin delivery systems when the following criteria are met (A, B, and C):

A. Member is age 8 and over.

B. Member falls into one of the following categories:
   i. Patient had Type 1 diabetes; or
   ii. Insulin pump therapy is being used as an adjunct to kidney transplant; or
   iii. Member is pregnant whether Type 1 or Type 2.

C. Type 2 diabetic patients who have performed self-monitored blood glucose (SMBG) testing averaging ≥ 4 readings with 80% compliance for 30 consecutive days within a previous 3 month period and has **ONE** of the following:
   i. Hemoglobin A1C ≥ 7.5; or
   ii. Recurrent hypoglycemic events as listed below*; or
   iii. Wide glucose excursions (daily fluctuations of 200mg/dL or more).

**For recurrent hypoglycemic events:*
*The Member has demonstrated significant hypoglycemic unawareness as manifested by any **ONE** of the following within the 6 months prior to the request:*
   1) *At least 1 ER visit specifically for a hypoglycemic conditions.*
   2) *At least 1 hospitalization for hypoglycemic complications.*
   3) *Clinical documentation supporting significant or frequent hypoglycemic issues.*

U of U Health Plans will only cover replacements if ALL of the following criteria are met:

A. The device is out of warranty and the device is malfunctioning; and

B. Malfunction or damage was not due to patient neglect or abuse; and

C. Member must have attended 2 diabetic medical provider visits within the last 12 months at least one of which must be with a prescribing provider and demonstrated compliance with therapeutic regimen.

2. Medicaid Plans

Coverage is determined by the State of Utah Medicaid program; if Utah State Medicaid has no published coverage position and InterQual criteria are not available, the U of U Health Plans Commercial criteria will apply. For the most up-to-date Medicaid policies and coverage, please visit their website at: https://medicaid.utah.gov/utah-medicaid-official-publications/ or the Utah Medicaid code Look-Up tool

CPT/HCPCS codes covered by Utah State Medicaid may still require further evaluation to determine medical necessity for coverage.

Clinical Rationale

Standard Insulin Pumps

Since the completion of the Diabetes Control and Complications Trial (DCCT) in 1993 and the introduction of Lispro (Humalog) insulin in 1996, children and adolescents with diabetes have increasingly turned to insulin pump therapy to maximize their diabetic control in an effort to slow the development of long term complications of poorly controlled diabetes.

The theoretical advantage of insulin pump therapy is its ability to mimic physiological insulin release and meet physiological insulin needs in people with insulin diabetes mellitus. The basal and bolus functions of the pump allow separate determination and adjustment of both these insulin requirements and also allow flexibility in timing and amounts of nutritional intake and physical activity, allowing wide variation in lifestyles. This flexibility allows for improved patient compliance and adherence to their diabetic regimen allowing for improved diabetic control.

In addition, use of the newer short-acting (Novalog or Humalog) or ultra-short acting insulins makes coverage of the early morning glucose rise ("Dawn phenomenon") easier, eases sick day management and matches nutrient absorption more physiologically, thereby reducing the risk of hypoglycemic complications.

Prior studies of pump users show a high degree of satisfaction and most show a decreased risk of severe hypoglycemia. Recent studies, additionally, have demonstrated improved effectiveness of diabetic control even in patients who have achieved good control (HgbA1C) using standard therapies.

The perceived advantages to the OmniPod insulin pump may lead members to desire this pump over standard insulin therapy. A Hayes review of this technology completed in 2020 and updated in December 2021 identified 5 studies that met the inclusion criteria and evaluated the efficacy and safety of the OmniPod system for the management of DM. The review concluded the overall very-low-quality body of evidence did not allow for conclusions to be drawn regarding the safety and efficacy of therapy with the OmniPod system. Evidence across studies was inconsistent in evaluations of the effect of the OmniPod system on HbA1c level reductions, with some studies showing a clinically and statistically significant reduction, some studies demonstrating no clinically significant reduction, and 1 study demonstrating a clinically significant increase in HbA1c levels at 3 years of follow-up. Reductions in insulin use were similarly inconsistent. It is not clear from the current evidence base whether the use of the OmniPod system results in a clinically significant improvement in HbA1c levels or insulin use in patients with type 1 DM over the long term. Overall quality was based on the balance of benefits and harms and was assessed taking into consideration the quality of individual studies; the precision, directness, and consistency of data; and the applicability of the data to general practice. Limitations of individual studies include small sample size, retrospective study design, lack of long-term data, and lack of power analyses.

With regard to the t:slim insulin delivery system, a technology review was completed in August of 2013. This review noted there is a lack of high-quality peer-reviewed evidence demonstrating the safety, efficacy and improvement in patient clinical outcomes associated with the t:slim insulin delivery device especially as it compares to currently alternative insulin pumps (Grade 2C). However, a multi-centered and prospective study by Schaeffer et al. which was sponsored by the manufacturer aimed at assessing real-world user's perceptions of the t:slim pump demonstrated this technology to have performance characteristics equivalent or in some instances superior to alternative insulin pumps currently available

to patients. This study also demonstrated user preference in many instances over other devices. The study concluded that reduced therapeutic complexity, in part, can be derived from improved device usability which may in turn lead to increase patient adherence. This study also demonstrated durability of this device in routine use.

A 2016 overview (McAdams et al), reported remarkable advances in replicating the natural pancreas function with continuous subcutaneous insulin, or the insulin pump, has gained popularity and sophistication as a near-physiologic programmable method of insulin delivery that is flexible and lifestyle-friendly. The introduction of continuous monitoring with glucose sensors provides unprecedented access to, and prediction of, a patient's blood glucose levels. Efforts are underway to integrate the two technologies, from "sensor-augmented" and "sensor-driven" pumps to a fully-automated and independent sensing-and-delivery system. Implantable pumps and an early-phase "bionic pancreas" are also in active development. Fine-tuned "pancreas replacement" promises to be one of the many avenues that offers hope for individuals suffering from diabetes.

Lastly, current standard manufacturers are continuing to evolve their devices. They have developed devices with continuous glucose monitoring capabilities along with other “bells and whistles”. By the time the OmniPod technology diffuses throughout the country and requests begin to increase, the manufacturers of the current standard technology may have evolved their devices to the point that this current OmniPod will not be perceived to have significant or any clinical advantages over their devices.

Closed Loop Systems

Trevitt, et al (2016) identified eighteen closed-loop APD systems that were identified and classified into subtypes according to their level of automation; the hormonal and glycemic control approaches used, and their research setting. All were being tested in clinical trials prior to potential commercialization. Six were being studied in the home setting, 5 in outpatient settings, and 7 in inpatient settings. It is estimated that 2 systems may become commercially available in the EU by the end of 2016, 1 during 2017, and 2 more in 2018. There are around 18 closed-loop APD systems progressing through early stages of clinical development. Only a few of these are currently in phase 3 trials and in settings that replicate real life.

In 2017 systematic review (Weisman, et al), 984 reports were identified; after exclusions, 27 comparisons from 24 studies including a total of 585 participants (219 in adult studies, 265 in pediatric studies, and 101 in combined studies) were eligible for analysis. Five comparisons assessed dual-hormone (insulin and glucagon), two comparisons assessed both dual-hormone and single-hormone (insulin only), and 20 comparisons assessed single-hormone closed-loop insulin delivery systems. Time in target was 12.59% higher with closed-loop insulin delivery systems (95% CI 9.02-16.16; $p<0.0001$), from a weighted mean of 58.21% for conventional pump therapy ($I(2)=84\%$). Dual-hormone closed-loop insulin delivery systems were associated with a greater improvement in time in target range compared with single-hormone systems (19.52% [95% CI 15.12-23.91] vs 11.06% [6.94 to 15.18]; $p=0.006$), although six of seven comparisons compared dual-hormone systems to CSII with blinded CGM, whereas 21 of 22 single-hormone comparisons had SAP as the comparator. Single-hormone studies had higher heterogeneity than dual-hormone studies ($I(2)$ 79% vs 66%). Bias assessment characteristics were incompletely reported in 12 of 24 studies, no studies masked participants to the intervention assignment, and masking of outcome assessment was not done in 12 studies and was unclear in 12 studies.

Hybrid Closed Loop Systems

UpToDate in their review of hybrid closed loop systems last updated in September 2023 noted the two partially automated (hybrid) closed-loop systems of insulin delivery commercially available in the United States (T-Slim X2 and Medtronic 670G). Additional models (Omnipod-5, and Medtronic 770G) have since

come to the market in the US. When using these insulin pump/CGM systems in the "auto" or "automatic" mode, instead of infusing basal insulin in mini-boluses every five minutes according to the programmed basal rates ("manual" mode), the system automatically gives a mini-bolus (or no bolus) of rapidly acting insulin every five minutes determined by an algorithm that is dependent on CGM results, target glucose, and the amount of active insulin on board.

With these "hybrid" closed-loop devices, the patient still needs to determine and administer pre-meal insulin boluses, which is facilitated with an individualized insulin-to-carbohydrate ratio set in the pump's bolus calculator. Some systems require periodic finger stick capillary glucose measurements for calibration and to address high or low values, and some have limited choices for the target glucose. Each of the available devices can transmit insulin dosing data (display of basal and bolus insulin delivery), CGM and SMBG data, as well as pump and CGM settings to cloud-based systems. These data can be retrieved and reviewed on demand.

For the first commercial hybrid closed-loop system in the United States, the few available small reports indicate that discontinuation rates in the real world are high. Substantial education and support for the patient as well as considerable diligence by the patient regarding self-care tasks are required to stay in "auto mode"; improvements are anticipated in future models.

In a meta-analysis of trials comparing the use of any hybrid closed-loop system with any insulin-based treatment in nonpregnant patients with type 1 diabetes, the proportion of time spent near normoglycemia (70 to 180 mg/dL [3.9 to 10 mmol/L]) over 24 hours was modestly, albeit significantly, higher with the hybrid closed-loop system (weighted mean difference 9.62 percent, 95% CI 7.54-11 percent). Overall, the incidence of severe hypoglycemia was low in both groups. Most of the trials examined short-term (one to three days) control. Only a few of the trials have examined the utility of these devices in the outpatient setting, during eating and usual daily activities, over a longer period.

The Hayes review noted in a crossover, random-order trial, 33 adults (mean A1C 8.5 percent [69.4 mmol/mol]) were assigned to either 12 weeks of partially automated (hybrid), closed-loop insulin delivery (intervention) followed by 12 weeks of sensor-augmented pump therapy (control), or to the opposite order (sensor-augmented pump therapy followed by hybrid, closed-loop insulin delivery). Patients performed their usual daily activities and were not monitored remotely by study staff. Compared with the sensor-augmented pump, use of the hybrid closed-loop system resulted in a greater proportion of time spent in the target range of 70 to 180 mg/dL (3.9 to 10 mmol/L; 67.7 versus 56.8 percent, mean difference 11 percentage points, 95% CI 8.1-13.8). The mean glucose level (157 versus 168 mg/dL) and the mean A1C level (7.3 versus 7.6 percent) were also lower during the closed-loop phase of insulin delivery. Hypoglycemia, as measured by the area under the curve when glucose was <63 md/dL (3.5 mmol/L), was lower during the closed-loop system than during the control period (169 versus 198 [mg/dL x min]). This same study in children and adolescents using the same device, but delivering insulin only overnight, 25 patients (mean A1C 8.1 percent [65 mmol/mol]) used the hybrid closed-loop insulin delivery system overnight and discontinued it before breakfast. Compared with the sensor-augmented insulin pump, use of the hybrid closed-loop system resulted in a greater proportion of nocturnal time spent with glucose levels in the target range of 70 to 145 mg/dL (3.9 to 8 mmol/L; 59.7 versus 34.4 percent, mean difference 24.7 percentage points, 95% CI 20.6-28.7). The mean overnight glucose level was lower with the closed-loop system (146 versus 176 mg/dL). The proportion of time spent with a blood glucose level <70 or <50 mg/dL (<3.9 or <2.8 mmol/L) was low and was not reduced during the closed-loop treatment arm (<4 and <1 percent, respectively).

The review also cited a subsequent six-month trial comparing a hybrid closed-loop system with a sensor-augmented insulin pump in 168 patients ≥14 years of age, the percentage of time in target range (70 to 180 mg/dL [3.9 to 10 mmol/L]) as measured with CGM was higher in the closed-loop group (71 versus 59

percent, risk-adjusted difference 11 percent, 95% CI 9-14). A1C levels improved in patients using the closed-loop system (7.4 to 7.06 percent) but did not change in controls (7.4 to 7.39 percent). Although there were no serious hypoglycemic events in either group, the percentage of time spent in hypoglycemia was lower in patients assigned to the closed-loop system (e.g., <54 mg/dL, 0.29 versus 0.35 percent, risk-adjusted difference -0.10, 95% CI -0.19 to -0.02). There were, however, more hyperglycemic adverse reactions, including one episode of ketoacidosis, in the closed-loop group (14 versus 2 patients), primarily due to infusion set failures. In a similarly designed 16-week trial in children 6 to 13 years of age, the percentage of time in target range was higher with the closed-loop system (67 versus 55 percent, mean adjusted difference 11 percentage points, 95% CI 7-14).

Implantable Insulin Pumps

A 2011 Medical Technology Assessment focused on the V-Go™ disposable insulin delivery system identified only 1 peer-reviewed article. In a proof of concept study, Kapitza et al. applied V-Go to the lower abdomen of 6 subjects once daily for 7 days. The device operated as the investigators expected with no mechanical defects reported. The group concluded that V-Go improved both glycemic control and glycemic variability. Glycemic variability decreased the margin of error by 5 mg/dl for both inpatient and outpatient populations. The study was thorough in that it studied clinical functionality, safety and pharmacodynamics. However, only 6 patients were followed over 1 week. No patient demographic information is given other than that all participants had Type 2 diabetes.

Due to the lack of randomized, prospective trials it is difficult to make any reasonable claim that V-Go improves patient outcomes over-and-above the standard of care. It is also impossible to assess clinical safety and efficacy of this device or to assess cost effectiveness of the device in comparison to insulin pumps currently in use.

A 2011 article (Zisser et al), describes two novel and easy approaches for assessing the accuracy of insulin pumps as implemented within the artificial pancreas system. The approaches are illustrated by data testing the OmniPod Insulin Management System at its lowest delivery volume (0.05 U) and at doses of 0.1, 0.2, 1, and 6U. In method 1, a pipette, digital microscope, and imaging software were used to measure average bolus delivery on a linear scale for multiple volumes. In method 2, a digital microscope and imaging software were used to measure the volume of a spherical bolus of 0.05 U of insulin. Bench testing results using the two novel methods demonstrated that the OmniPod is extremely accurate, with a relative error ranging from -0.90% to +0.96% for all measured doses (0.05, 0.1, 0.2, 1, and 6 U). In method 1, at target bolus dose of 0.05 U, the mean delivered dose (+/- standard deviation) was 0.0497 +/- 0.003 U, 0.099 +/- 0.005 U at 0.1 U, 0.2 +/- <1e-5 U at 0.2 U, 1.001 +/- 0.018 U at 1 U, and 6.03 +/- 0.04 U at 6 U. In method 2, at target bolus dose of 0.5 ml, the mean delivered dose for both OmniPods was 0.505 +/- 0.014. In conclusion, both methods confirmed a high degree of accuracy for the OmniPod insulin pump. These techniques can be used to estimate delivery volume in other infusion pumps as well.

A 2014 study (Borot et al), aimed to evaluate the infusion accuracy of the JewelPUMP (JP), a new patch pump based on a microelectromechanical system that operates without any plunger, in vitro and in vivo. For the in vitro studies, commercially available pumps meeting the ISO standard were compared to the JP: the MiniMed(R) Paradigm(R) 712 (MP), Accu-Chek(R) Combo (AC), OmniPod(R) (OP), Animas(R) Vibe (AN). Pump accuracy was measured over 24 hours using a continuous microweighing method, at 0.1 and 1 IU/h basal rates. The occlusion alarm threshold was measured after a catheter occlusion. The JP, filled with physiological serum, was then tested in 13 patients with type 1 diabetes simultaneously with their own pump for 2 days. The weight difference was used to calculate the infused insulin volume. The JP showed reduced absolute median error rate in vitro over a 15-minute observation window compared to other pumps (1 IU/h): +/-1.02% (JP) vs +/-1.60% (AN), +/-1.66% (AC), +/-2.22% (MP), and +/-4.63% (OP),

P < .0001. But there was no difference over 24 hours. At 0.5 IU/h, the JP was able to detect an occlusion earlier than other pumps: 21 (19; 25) minutes vs 90 (85; 95), 58 (42; 74), and 143 (132; 218) minutes (AN, AC, MP), P < .05 vs AN and MP. In patients, the 24-hour flow error was not significantly different between the JP and usual pumps (-2.2 +/- 5.6% vs -0.37 +/- 4.0%, P = .25). The JP was found to be easier to wear than conventional pumps. The JP is more precise over a short time period, more sensitive to catheter occlusion, well accepted by patients, and consequently, of potential interest for a closed-loop insulin delivery system.

In January 2016 the Animas Corporation received FDA approval for the use of the Animas Vibe® Insulin Pump and Continuous Glucose Monitoring (CGM) System for the management of diabetes in children and adolescents, ages 2 to 17. The Animas Vibe System was the first integrated system featuring Dexcom G4® PLATINUM CGM technology, and is the only such system available in the U.S. for pediatric patients as young as age two. The Animas® Vibe® System allows patients and their caregivers to view glucose data and administer insulin right from the pump, making it easy to fine tune insulin delivery to help manage their diabetes.

Applicable Coding

CPT Codes

No applicable codes identified

HCPCS Codes

A4224	Supplies for maintenance of insulin infusion catheter, per week
A4225	Supplies for external insulin infusion pump, syringe type cartridge, sterile, each
A4230	Infusion set for external insulin pump, non-needle cannula type
A4231	Infusion set for external insulin pump, needle type
A4232	Syringe with needle for external insulin pump, sterile, 3 cc
A9274	External ambulatory insulin delivery system, disposable, each, includes all supplies and accessories
E0784	External ambulatory infusion pump, insulin
J1817	Insulin for administration through DME (i.e., insulin pump) per 50 units
S1034	Artificial pancreas device system (e.g., low glucose suspend [LGS] feature) including continuous glucose monitor, blood glucose device, insulin pump and computer algorithm that communicates with all of the devices
S1035	Sensor; invasive (e.g., subcutaneous), disposable, for use with artificial pancreas device system
S1036	Transmitter; external, for use with artificial pancreas device system
S1037	Receiver (monitor); external, for use with artificial pancreas device system
S5550	Insulin, rapid onset, 5 units
S5551	Insulin, most rapid onset (Lispro or Aspart); 5 units

S5552	Insulin, intermediate acting (NPH or LENTE); 5 units
S5553	Insulin, long acting; 5 units
S5565	Insulin cartridge for use in insulin delivery device other than pump; 150 units
S5566	Insulin cartridge for use in insulin delivery device other than pump; 300 units
S9145	Insulin pump initiation, instruction in initial use of pump (pump not included)
S9353	Home infusion therapy, continuous insulin infusion therapy; administrative services, professional pharmacy services, care coordination, and all necessary supplies and equipment (drugs and nursing visits coded separately), per diem

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