SUMMARY OF SAFETY AND EFFECTIVENESS DATA (SSED)

I. GENERAL INFORMATION

Device Generic Name: Artificial Pancreas Device System, Threshold Suspend

Device Trade Name: MiniMed 630G System

Device Procode: OZO, Artificial pancreas device system, Threshold Suspend

Applicant's Name and Address: Medtronic MiniMed, Inc.
18000 Devonshire Street
Northridge, CA 91325

Date(s) of Panel Recommendation: None

Premarket Approval Application (PMA) Number: P150001/S021

Date of FDA Notice of Approval: February 13, 2018

Priority Review: Not Applicable

The original PMA (P150001) was approved on August 10, 2016 and is indicated for continuous delivery of basal insulin (at user selected rates) and administration of insulin boluses (in user selectable amounts) for the management of diabetes mellitus in persons, sixteen years of age and older, requiring insulin as well as for the continuous monitoring and trending of glucose levels in the fluid under the skin. The SSED to support the indication is available on the CDRH website and is incorporated by reference here. On June 2, 2017, FDA approved the use of Guardian Sensor (3) with the MiniMed 630G System in persons fourteen years of age and older in P150001/S008. The current supplement was submitted to expand the indication for the Guardian Sensor (3) by adding the upper arm as an approved insertion site for the sensor.

II. INDICATIONS FOR USE

MiniMed 630G System with SmartGuard
The MiniMed 630G System with SmartGuard is intended for continuous delivery of basal insulin (at user selected rates) and administration of insulin boluses (in user selectable amounts) for the management of diabetes mellitus in persons fourteen years of age and older requiring insulin, as well as for the continuous monitoring and trending of glucose levels in the fluid under the skin.

The MiniMed 630G system includes SmartGuard, which can be programmed to temporarily suspend delivery of insulin for up to two hours when the sensor glucose value falls below a predefined threshold value. The MiniMed 630G System with SmartGuard consists of the following devices: MiniMed 630G Insulin Pump, Guardian Sensor (3), One-press serter,

Guardian Link (3) transmitter system, CareLink USB, CONTOUR NEXT LINK 2.4 Wireless Meter, and CONTOUR NEXT Test Strips. The system requires a prescription.

The MiniMed 630G System with SmartGuard is not intended to be used directly for making therapy adjustments, but rather to provide an indication of when a finger stick may be required. All therapy adjustments should be based on measurements obtained using a home glucose monitor and not on values provided by the MiniMed 630G system.

The MiniMed 630G System with SmartGuard is not intended to be used directly for preventing or treating hypoglycemia but to suspend insulin delivery when the user is unable to respond to the SmartGuard Suspend on Low alarm to take measures to prevent or treat hypoglycemia themselves. Therapy to prevent or treat hypoglycemia should be administered according to the recommendations of the user's healthcare provider.

Guardian Sensor (3)
The Guardian Sensor (3) is intended for use with the Medtronic MiniMed 630G and MiniMed 670G systems to continuously monitor glucose levels in persons with diabetes. It is intended to be used for detecting trends and tracking patterns in persons aged fourteen years and older. It is indicated for use as an adjunctive device to complement, not replace, information obtained from standard blood glucose monitoring devices. The sensor is intended for single use and requires a prescription. The Guardian Sensor (3) is indicated for 7 days of continuous use.

One-press Serter
The One-press Serter is used as an aid for inserting the sensor. It is indicated for single-patient use and it is not intended for multiple-patient use.

Guardian Link (3) Transmitter
The Guardian Link (3) Transmitter is intended for use with the MiniMed 670G System. The Guardian Link (3) Transmitter powers the glucose sensor, collects and calculates sensor data, and wirelessly sends the data to the MiniMed 670G insulin pump. The Transmitter is intended for single-patient multi-use.

Contour NEXT Link 2.4 Glucose Meter
The Contour Next Link 2.4 Wireless Blood Glucose Monitoring System is an over the counter (OTC) device utilized by persons with diabetes in home settings for themeasurement of glucose in whole blood, and is for single patient use only and should not be shared. The Contour Next Link 2.4 wireless blood glucose monitoring system is indicatedfor use with fresh capillary whole blood samples drawn from the fingertip and palm only.
The Contour NEXT Test Strips are intended for self-testing by persons with diabetes for the quantitative measurement of glucose in whole blood samples from 20 to 600 mg/dL. The Contour Next Link 2.4 wireless blood glucose monitoring system is intended to be used to transmit glucose values to the MiniMed 670G pump and facilitate transfer of information to Medtronic CareLink Software through the use of radio frequency communication. The Contour Next Link 2.4 Wireless Blood Glucose Monitoring System is not intended for the diagnosis of, or screening for, diabetes mellitus. It is not intended for use on neonates.

III. CONTRAINDICATIONS

The MiniMed 630G System with Smart Guard user guide contains the following warning:

> The SmartGuard feature will cause the pump to temporarily suspend insulin delivery for two hours when the sensor glucose reaches a set threshold. Under some conditions of use the pump can suspend again resulting in very limited insulin delivery. Prolonged suspension can increase the risk of serious hyperglycemia, ketosis, and ketoacidosis. Before using the SmartGuard feature, it is important to read the SmartGuard information in the Getting Started Guide and the MiniMed 630G System User Guide and discuss proper use of the SmartGuard feature with your healthcare provider.

The MiniMed 630G System with SmartGuard user guide contains the following contraindications:

- Pump therapy is not recommended for people who are unwilling or unable to perform a minimum of four blood glucose tests per day.
- Pump therapy is not recommended for people who are unwilling or unable to maintain contact with their healthcare professional.
- Pump therapy is not recommended for people whose vision or hearing does not allow recognition of pump signals and alarms.

IV. WARNINGS AND PRECAUTIONS

The warnings and precautions can be found in the MiniMed 630G System with SmartGuard labeling.

V. DEVICE DESCRIPTION

There is no physical change to the MiniMed 630G System as a result of this panel track supplement. The MiniMed 630G system is comprised of the following devices:

MiniMed 630G Insulin Pump (MMT-1715)

The MiniMed 630G Insulin Pump is an ambulatory, battery operated, rate-programmable infusion pump designed to deliver insulin from a reservoir. The reservoir is driven by a motor to deliver patient determined basal rate profiles and patient selected bolus amounts of insulin into the subcutaneous tissue through an FDA-cleared infusion set.

The MiniMed 630G Insulin Pump is offered as model MMT-1715. This model uses a 3.0 mL insulin reservoir, and displays blood-glucose (BG) units in mg/dL. The device does not offer users the option to change unit measures.

The MiniMed 630G Insulin Pump is similar to the MiniMed 530G pump (P120010) hardware and software platform. Both pumps share a similar mechanical pump design, and both pumps use the same threshold suspend control algorithm. The major difference

between the hardware of the two pumps is the use of a color screen and updated button interface in the 630G.

The MiniMed 630G Insulin Pump is designed to receive and display real-time glucose values received from the provided transmitter. Enlite sensor signals are transmitted from the transmitter to the MiniMed 630G Insulin Pump via RF telemetry and converted into glucose concentrations based on calibration values from either the included Bayer Contour blood glucose meters, or commercially available blood glucose meters. Signals are updated and transmitted to the pump every five minutes.

The real time sensor glucose values, displayed by the MiniMed 630G Insulin Pump, are not intended to be used directly for making therapy adjustments. The patient can use the tracking and trending of sensor glucose values to help determine if an unplanned finger stick measurement may be needed. In addition, sensor glucose values should not be used to modify insulin therapy. All insulin therapy adjustments should be based on measurements obtained using a blood glucose meter and not based on the sensor glucose value displayed by the MiniMed 630G Insulin Pump.

The MiniMed 630G System with SmartGuard uses the same Threshold Suspend system as the MiniMed 530G system. This tool provides the patient the means to set the pump to temporarily suspend insulin delivery automatically for up to two hours when the sensor glucose level is equal to or less than a selected threshold. The patient has the capability to select a 'Threshold Suspend' threshold within the 60 mg/dL to 90 mg/dL range. When the 'Threshold Suspend' tool is set to 'ON,' the system compares the sensor glucose value to the programmed Suspend threshold whenever the sensor glucose value is updated (every five minutes). When the sensor glucose value is below the set threshold, a user-defined alarm occurs and the patient may elect to continue or cancel the temporary pump suspension of insulin delivery. If the user does not respond to the initial alarm within a preset time, an emergency siren alarm is sounded and insulin is suspended.

The use of the Threshold Suspend tool is optional and the patient can turn the tool 'ON' and 'OFF'.

If the user does not respond to the alarm or siren, the pump will automatically suspend for two hours. At the end of the two hours, insulin delivery will resume and the system will be unable to suspend the pump automatically for four hours post-insulin resumption even if the sensor glucose value is below the threshold.

If the user cancels the suspension of insulin delivery, the system will continue to deliver insulin at the programmed basal rate until the next time the sensor glucose value is below the set threshold value. The user-defined alarm will then re-sound, followed by a siren if not acknowledged, and the pump will suspend (unless canceled by the user). The interval between the cancellation of the Threshold Suspend and the next possible threshold alarm will be the duration of the patient's specified Low Alert Repeat (5-60 minutes).

If the patient responds to the alarm or siren by electing to accept the insulin suspension, the pump will suspend. At the end of the two hours, the pump will resume insulin delivery until the next sensor glucose value is below the set threshold suspend value. The interval between the accepted Threshold Suspend and the next possible threshold alarm will be the

duration of the patient's specified Low Alert Repeat (5-60 minutes). This means that it is possible for the system to suspend insulin delivery for two hours, followed by a minimal amount of insulin delivery (5 minutes), and re-suspend insulin delivery for two more hours. This loop can be continued for as long as the patient acknowledges the pump suspension (by electing to continue) and the sensor value remains below the set threshold value.

The patient can cancel the temporary pump suspension at any time during the two-hour period regardless if the suspension occurred because he/she was not able to respond to the initial alarm or he/she accepted the suspension.

The MiniMed 630G Insulin Pump is capable of storing 90 days of pump history and glucose sensor data. The pump has a graphical display that the patient can use to view the glucose history for the past 3, 6, 12 and 24 hours, high/low glucose alarms and display of retrospective glucose trend information.

Stored pump history and glucose data can be downloaded to a personal computer for review and analysis, to track patterns and improve diabetes management. Data is downloaded from the pump to CareLink therapy management software.

Guardian Link Transmitter System (MMT-7811)

The Guardian Link Transmitter System consists of the Guardian Link Transmitter (MMT-7811), the Charger (model MMT-7715), and the Tester (model MMT-7736).

The Guardian Link Transmitter interfaces directly with the glucose-sensor assembly. The Guardian Link Transmitter provides power to the glucose sensor, and measures the sensor signal current from the glucose sensor.

The sensor signal current is an electrical current level that is proportional to the glucose level in the user's subcutaneous interstitial fluid. The sensor signal current is converted to a digital signal, which is filtered to reduce noise artifacts. This digital signal is sent to the MiniMed 630G pump every 5 minutes, using radio frequency (RF).

Guardian Sensor (3) (MMT-7020)

The Guardian Sensor (3) is a sterile, single-use, single patient glucose sensing component for continuous monitoring of glucose levels in the user's interstitial fluid, when inserted in the user's abdomen or arm for up to seven days. The Sensor is inserted into the subcutaneous tissue using the One-Press Serter and is taped to the user's skin. It connects to the Guardian Link Transmitter, which in turn communicates with the MiniMed 630G Pump. Though originally approved (P150001) for insertion into the abdomen only, in this supplement the sensor is now approved for insertion into the upper arm in addition to the abdomen.

When making treatment decisions, such as determining insulin dose for meals, the 630G continuous glucose monitor (CGM) values should not be used, as they are not intended to be used to make such treatment decisions. The 630G continuous glucose monitor does not

replace a blood glucose meter. Users should always use the values from a blood glucose meter for treatment decisions. Blood glucose values may differ from sensor glucose values. Using the sensor glucose readings for treatment decisions could lead to unwanted high or low blood glucose.

Users should calibrate the Guardian Sensor at least every 12 hours using meter blood glucose values. Calibration is necessary for sensor function, and more frequent calibration can help to increase the accuracy of the sensor. The system requires a minimum of two calibrations per day, and four calibrations per day are recommended. The system is contraindicated for patients unwilling or unable to do frequent blood glucose meter measurements.

If the user obtains blood glucose values using the Contour Next Link 2.4 Meter, the user may transmit blood glucose values via Bluetooth to the 630G pump to be used for sensor calibrations. If the user uses a different FDA cleared blood glucose meter to calibrate the Guardian Sensor, the user must manually input the blood glucose values into the pump to be used for sensor calibration. Additionally, users who use the Contour Next Link 2.4 should calibrate with values obtain using fingersticks; users should not use readings obtained from blood from alternative sites (e.g., palm).

One-Press Serter
The One-Press serter is a sensor insertion device which aids the user in inserting the Guardian Sensor. The serter was also previously reviewed and approved under P120010/S070. The user must use the One-Press Serter in order to insert the Guardian Sensor.

Contour Next Link 2.4 Meter (MMT-1352 and MMT-1152) and Test Strips The Contour Next Link 2.4 Meter can be used with the 630G system; the meter wirelessly sends blood glucose values to the insulin pump for sensor calibration via Bluetooth. The meter was also previously cleared under k110894. Specifications and performance requirements were established for the meter and evaluated as part of the class III 630G System.

Additional System Accessories
The following additional accessory devices are compatible with the 630G Insulin Pump (Table 1):

Table 1: Accessory Devices

Device	Model
Reservoirs and Infusion Sets	**Model Numbers**
MiniMed Quick Set Infusion Set	MMT-386, MMT-387, MMT-394, MMT-396, MMT-397, MMT-398, MMT-399
MiniMed Silhouette Infusion Set	MMT-368, MMT-369, MMT-370, MMT-377, MMT-378, MMT-381, MMT-382, MMT-383, MMT-384

MiniMed Mio Infusion Set	MMT-921, MMT-923, MMT-925, MMT-941, MMT-943, MMT-945, MMT-965, MMT-975
MiniMed Sure-T Infusion Set	MMT-862, MMT-864, MMT-866, MMT-874, MMT-876, MMT-886
Paradigm Reservoir	MMT-332A
Optional Devices	**Model Numbers**
CareLink USB 2.4	MMT-7306
CareLink Online (Personal)	MMT-7333
CareLink Pro	MMT-7335

VI. ALTERNATIVE PRACTICES AND PROCEDURES

Control of diabetes can be achieved through a combination of methods and behaviors.

Self behaviors include healthy eating, taking the clinically indicated medications, and being active. Persons with diabetes may also administer insulin by injection or by using other insulin infusion pumps as prescribed by his/her physician. Methods of controlling glucose levels (glycemic control) have been shown to reduce severe diabetes-related complications.

Methods of monitoring glycemic control include periodic measurement of Hemoglobin A_{1c} (HbA_{1c}), which reflects blood glucose control over a three month period. Self-monitoring of blood glucose using glucose meters and test strips provides quantitative measurements of blood glucose at a single point in time for patients and their healthcare providers to monitor the effectiveness of glycemic control and make more immediate treatment modifications.

There are similar insulin pumps and combined pump-CGM systems currently on the market from this sponsor and other sponsors. Each alternative method for monitoring glycemic control has its own advantages and disadvantages. A patient should fully discuss these alternatives with his/her physician to select the method that best meets expectations and lifestyle.

VII. MARKETING HISTORY

The MiniMed 630G System has been marketed in the United States since August 2016. The device has not been withdrawn from marketing for any reason related to its safety or effectiveness.

VIII. POTENTIAL ADVERSE EFFECTS OF THE DEVICE ON HEALTH

Below is a list of the potential adverse effects (e.g. complications) associated with the use of the device.

The following events are possible adverse device effects of inserting a sensor into your skin: local infection, inflammation, pain or discomfort, bleeding at the glucose sensor insertion site, bruising, itching, scarring or skin discoloration, hematoma, tape irritation,

sensor or needle fracture during insertion, wear or removal. There were no reports of subject death, unanticipated adverse device effect (UADE), diabetic ketoacidosis, or serious adverse events related to the device or study procedure during any of the clinical studies (G140053, G110044, G110131/A001 and G100028). No sensor breakage was documented in the clinical studies supporting approval of this device. Reported sensor breakage rate with similar devices has been very low, however, and this study was not powered or designed to assess the rate of breakage.

A minor risk of the CGM is that patients may need to perform unnecessary fingersticks to evaluate their blood glucose when the CGM gives false positive hypoglycemic and hyperglycemic readings or alerts. There is also a minor risk of skin irritation, inflammation, or infection due to either the sensor needle or the adhesive. However, CGM devices allow patients to measure the interstitial glucose at near continuous intervals to obtain a 24 hour picture of their glucose profile, especially during the night. Tracking and trending information is of value to patients and outweighs minor risks associated with fingersticks and the sensor.

There are additional risks due to missed alerts and false negative hypoglycemic and hyperglycemic readings related to patients not being alerted to the need to perform a fingerstick to detect hypoglycemia or hyperglycemia. Additionally, there is a risk associated with false alerts and false positive hypoglycemia and hyperglycemia readings related to the need to perform unnecessary fingersticks to confirm an erroneous low or high reading. Patients who only use blood glucose meters to manage their diabetes without the aid of a CGM would also be unaware of the need to perform additional testing to detect an abnormal blood sugar (unless they were exhibiting symptoms of an abnormal blood glucose).

The risks of inaccurate Enlite sensor glucose results is not unreasonably higher than the risk of managing diabetes with a blood glucose meter alone and these include incorrect tracking and trending or threshold detection; increased false negative and false positive low threshold alerts and alarms or high threshold alerts, and incorrect rate of change calculations that could adversely affect treatment decisions. However, if the patient relies on sensor glucose values and does not perform fingerstick blood glucose tests as recommended (4-7 times daily) the risks of CGM use increases; especially if the sensor error results in failure to detect glucose out of the target glucose range (failure of Low and High alerts) or incorrect insulin dosing.

Inaccurate calculation of the rate of change of interstitial glucose by the CGM could result in failure to identify trends of increasing or decreasing glucose and alerts to the patient that an unplanned blood glucose check should be performed. Rate of change detection errors result in the patient losing the opportunity to perform additional blood glucose tests and take appropriate measures to stop a trend of increasing or decreasing glucose levels that could lead to serious hypoglycemia or hyperglycemia. Inaccurate calculation of the rate of change of glucose could also lead to unnecessary additional blood glucose tests. As discussed above the risk of using sensor rate of change information for making treatment

decisions, rather than as a prompt for unplanned blood glucose checks, increases the risk of CGM use.

There are risks associated with using the Threshold Suspend tool. As with the sensor based alerts, the threshold alarm is subject to sensor errors that can result in missed hypoglycemia and no pump suspension, or inappropriate pump suspension when blood glucose is above the sensor suspend threshold (suspension in the absence of hypoglycemia) potentially resulting in hyperglycemia and ketosis. Under certain conditions of use after the initial 2-hour suspension the pump will resume insulin delivery but can re-suspend after a short period of time (as little as 5-minutes) rather than after 4 hours. Repeated pump suspensions, especially if the initial suspension was in error, increases the risk of more severe hyperglycemia, ketosis, and possibly DKA. Patients using insulin pumps can manually suspend insulin or set a temporary basal rate of zero at any time, which can also result in hyperglycemia, ketosis, and possibly DKA if the interruption of insulin delivery is prolonged. Data from the ASPIRE study (G110044/S002) suggested that the use of the Threshold Suspend feature may potentially worsen glycemic control. Increased incidences of blood and urine ketones were observed in the Threshold Suspend group as compared to the Control group. When ketone levels were reported, the mean blood ketone concentration was higher in the Threshold Suspend group than in the Control group. In addition, more patients in the Threshold Suspend group reported positive ketone values when they exhibited symptoms (nausea, vomiting or abdominal pain). These hyperglycemia risks might be further amplified in patients with worse baseline control compared to those enrolled in the ASPIRE study. The risks of the Threshold Suspend tool can be mitigated if patients do not rely on the tool for treating or mitigating hypoglycemia if they are aware of Low Alerts or Threshold Suspend alarms, perform blood glucose checks, and treat hypoglycemia as instructed by their healthcare providers. Patients should also not rely on the sensor to detect hypoglycemia and perform blood glucose checks in response to symptoms of hypoglycemia. These risks were evaluated during the review of the MiniMed 530G System (P120010/S046). See the Summary of Safety and Effectiveness Data for the MiniMed 530G for additional information.

Risks of pump hardware problems include the following: possible hypoglycemia from over-delivery of insulin due to a hardware defect, as well as hyperglycemia and ketosis possibly leading to ketoacidosis due to inappropriate insulin suspension, occlusion of the infusion set, or pump failure resulting in cessation of all insulin delivery due to either a hardware defect or software anomaly

For information on adverse events that occurred in the clinical studies, please see Section X below.

IX. SUMMARY OF NONCLINICAL STUDIES

A. Laboratory Studies

Please see the SSED for P150001 for descriptions of the pre-clinical testing of the MiniMed 630G system and components.

B. Animal Studies
None.

C. Additional Studies
None.

X. SUMMARY OF PRIMARY CLINICAL STUDY(IES)

Medtronic conducted a study to evaluate the performance of the Guardian Sensor (3) to support a full 168 hours (7 days) of use under IDE # G140053. This study included evaluation of sensors inserted into both the abdomen and the upper arm and served as the primary clinical study for this Panel Track Supplement. A summary of the clinical study is presented below.

A. Study Design

The data submitted in support of this Panel Track Supplement was collected between April 30, 2015 and August 25, 2016 and included 89 patients. There were 6 investigational sites.

This study was a multi-center, prospective, single-sample correlational study without a control group, designed to determine the performance of the Guardian Sensor (3) in adolescents and adults with Type I or Type II Diabetes Mellitus between the ages of 14-75 years. All subjects wore two CGMs in the abdomen and one CGM in the upper arm. One of the abdomen CGMs consisted of a Guardian Sensor (3) (also referred to as the Guardian sensor below) connected to the Guardian Link (3) transmitter, which transmitted to the insulin pump (for display purposes only). The other abdomen CGM used the Guardian Sensor (3) connected to a transmitter with the same real-time algorithm as the Guardian Link (3) transmitter, which transmitted to a display device. The CGM sensor worn in the upper arm was connected to a recording device. Data from the arm sensor was downloaded at the end of the study and reprocessed using the same real-time algorithm as the abdomen sensors.

Subjects wore the Guardian sensor for a 7-day training period (that included a minimum 6 days of sensor wear), followed by a 7-day study period. During the study period, each subject participated in three in-clinic, frequent sample testing interventions. Frequent sample testing occurred at the beginning (Day 1), middle (Day 3) and end (Day 7) of the Guardian sensor system use. During these FST sessions, intravenous (IV) blood samples were drawn every 5 to 15 minutes and analyzed for plasma blood glucose levels using the comparator method (CM). The CM is this study was the Yellow Springs Instrument 2300 Stat Plus Glucose Lactate Analyzer. Frequent sample testing with the CM lasted approximately 12 to 14 hours during the in-clinic visit.

Subjects were randomized to one of 2 groups that determined when they participated in the in-clinic frequent sample testing; a day cohort (hours 1-12) and an evening cohort

(hours 12-24).

Subjects continued with their current diabetes regimen independent of the study devices. Subjects were instructed by the investigational center that they were not to use the investigational devices for the management of their diabetes.

There was no control group as this study was an observational study to determine the accuracy and precision of the Guardian sensor. Accuracy was assessed by comparing the sensor values to the CM, and precision of the sensor system was assessed by comparing sensor values from the arm to the sensor values in one abdomen sensor for each subject.

1. Clinical Inclusion and Exclusion Criteria

   Enrollment in the Guardian sensor study was limited to subjects who met the following inclusion criteria:

   1. Subject is 14 - 75 years of age at time of screening
   2. A clinical diagnosis of type 1 or 2 diabetes for a minimum of 12 month duration, as determined via medical record or source documentation by an individual qualified to make a medical diagnosis
   3. Adequate venous access as assessed by investigator or appropriate staff
   4. Subjects participating in the high and low glucose challenges must have an established insulin: carbohydrate ratio(s) and insulin sensitivity ratio. (The term "established" refers to a ratio that has been previously defined and tested prior to screening visit). Subjects without established ratios may be enrolled but will not be subjected to high and low glucose challenges.

   Subjects were not permitted to enroll in the Guardian sensor study if they met any of the following exclusion criteria:

   1. Subject will not tolerate tape adhesive in the area of Guardian Sensor placement as assessed by qualified individual
   2. Subject has any unresolved adverse skin condition in the area of Guardian Sensor or device placement (e.g., psoriasis, rash, *Staphylococcus* infection)
   3. Subject is actively participating in an investigational study (drug or device) wherein they have received treatment from an investigational study (drug or device) in the last 2 weeks
   4. Subject is female and has a positive pregnancy screening test
   5. Females of child bearing age and who are sexually active should be excluded if they are not using a form of contraception deemed reliable by investigator
   6. Subject is female and plans to become pregnant during the course of the study
   7. Subject has had a hypoglycemic seizure within the past 6 months
   8. Subject has had hypoglycemia resulting in loss of consciousness within the past 6 months prior to screening visit
   9. Subject has had an episode of DKA within the past 6 months prior to screening visit

10. Subject has a history of a seizure disorder
11. Subject has central nervous system or cardiac disorder resulting in syncope
12. Subject has a history of myocardial infarction, unstable angina, coronary artery bypass surgery, coronary artery stenting, transient ischemic attack (TIA), cerebrovascular accident (CVA), angina, congestive heart failure, ventricular rhythm disturbances or thromboembolic disease
13. Subject has a hematocrit (Hct) lower than the normal reference range
14. Subject has a history of adrenal insufficiency

2. Follow-up Schedule

At the end of the study, subjects removed all study devices. Upon removal, all the Sensor insertion sites were examined and evaluated by the study staff. Sensors were visually inspected at the site. Study investigators documented any Adverse Device Effects (including skin irritations) and evaluated safety issues related to system use during the study. No long-term follow up was included in this study protocol.

3. Clinical Endpoints

Because this was an observational study, it did not include traditional analysis of clinical endpoints. The data were presented using multiple analyses as described in the Study Results section below.

Safety of the sensor was determined by skin and insertion site reactions.

B. Accountability of PMA Cohort

Of the 93 subjects that entered the study, 4 subjects failed the screening, and 89 subjects were randomized into one of two groups that determined when they participated in the in-clinic frequent sample testing (day testing or night testing). Of these 89 randomized subjects, 7 subjects did not complete the study for the following reasons:

- One subject withdrew their informed consent
- One subject withdrew due to work schedule
- One subject withdrew due to school schedule
- One subject did not show up for insertion visit
- After review of study dates, one subject withdrew.
- A sensor failed on frequent sampling day 7 and subject did not have adequate time off work to reschedule
- After a sensor fell out due to sweating, before frequent sample day 7, the subject decided to withdraw so they did not have to complete a second round of frequent sample testing.

A total of 82 subjects underwent frequent sample testing and completed the study. Eighty-eight (88) subjects completed the first frequent sample testing on day 1, 87 subjects completed frequent sample testing on day 3, and 79 subjects completed frequent sample testing on day 7. Three (3) subjects completed the study by attending the last

visit, but did not complete frequent sample testing on day 7.

C. Study Population Demographics and Baseline Parameters

The demographics of the study population are typical for a pivotal CGM accuracy study performed in the US.

Table 2A: Study Population Demographics

Characteristics	**All Subjects (N=89)**
Age (years)	
N	89
Mean (SD)	41.7 (19.14)
Median	42
Min, Max	15.0, 75.0
Gender, number (%)	
Female not of child bearing potential	16 (18.0%)
Female of child bearing potential	27 (30.3%)
Male	46 (51.7%)
Race, number (%)	
Asian	3 (3.4%)
Black/African American	8 (9.0%)
Native Hawaiian/other Pacific	1 (1.1%)
Other	3 (3.4%)
White	74 (83.1%)
Ethnicity, number (%)	
Hispanic/Latino	3 (3.4%)
Non-Hispanic/Non-Latino	86 (96.6%)
Height (cm)	
N	89
Mean (SD)	171.6 (9.24)
Median	170.4
Min, max	148.5, 198.2
Weight (kg)	
N	89
Mean (SD)	83.3 (24.16)
Median	77
Min, max	45.9, 188.6
Body mass index (kg/m2)	
N	89
Mean (SD)	28.2 (7.14)
Median	26.5
Min, Max	17.9, 53.2
A1C (%)	
N	89

Mean (SD)	7.9 (1.38)
Median	7.8
Min, max	5.3, 12.6

Table 2B: Baseline Parameters

Characteristics	**All Subjects N=89**
Hematocrit (%)	
N	89
Mean (SD)	43.8 (3.61)
Median	43.3
Min, max	35.3, 52.8
Systolic blood pressure (mmHg)	
N	89
Mean (SD)	120.6 (14.41)
Median	120
Min, max	87.0, 164.0
Diastolic blood pressure (mmHg)	
N	89
Mean (SD)	76.8 (8.52)
Median	78
Min, max	57.0, 97.0

D. Safety and Effectiveness Results

1. Safety Results

The analysis of safety was based on the entire study cohort of 89 subjects. The key safety outcomes for this study are presented below.

Adverse effects that occurred in the PMA clinical study:

The safety of the Guardian Sensor was assessed by evaluation of the incidence of all adverse events, Adverse Device Effects (ADEs), Serious Adverse Device Events (SADEs), and Unanticipated Adverse Device Effects (UADEs) experienced by study subjects. Adverse events (AEs) were listed in terms of severity and relationship to device. Sensor insertion site and adhesive area were examined for erythema, edema and infection. The local skin reactions from the insertion site or the adhesive were also evaluated.

There were five (5) AEs reported during the study. All adverse events were resolved and subjects recovered completely without residual sequelae:

- There was one report of gastroenteritis, thought to be viral infection related.
- There was one report of worsening of benign prostatic hypertrophy, requiring Foley catheter insertion by the subject's urologist.

- There was one report of rash at the IV site, which cleared up by the next day without intervention.
- There was one report of upper respiratory symptoms that resolved.
- There was one report of a skin blister from skin tac used under tape.

There were no reports of subject death.
There were no reports of device-related serious adverse events (SAEs).
There were no reports of DKA.
There were no reports of severe hyperglycemia.
There were no reports of severe hypoglycemia.
There were no reports of non-device-related SAEs.
There were no reports of device-related adverse events.
The incidence of adverse events directly related to the CGM in the intended use population is not expected to differ significantly from the event rate observed during the Sensor accuracy study (G140053) or those observed for other approved CGM devices. Based on (FDA-analyzed) postmarket adverse event reports for similar CGM devices, no additional concerns regarding adverse events were raised for CGMs.

2. Effectiveness Results

The analysis of effectiveness was based on the observed accuracy of the sensor in 82 evaluable patients. The data are presented in Tables 3 to 34 below.

Tables 3 to 6 provide the Guardian sensor values and the percent difference with respect to comparator method (CM) values when the sensor was calibrated every 12 hours and when the sensor was calibrated three to four times per day, for senors inserted in the abdomen and upper arm locations, respectively.

Table 3: CGM Difference to CM within Reference Glucose Range, Calibrating Every 12 hours, Abdominal Insertion Site

CM Glucose Ranges (mg/dL)	Number of Paired CGM-CM Points	Mean Absolute Percent Difference (%)	Median Absolute Percent Difference (%)
Overall	12090	10.55	7.84
<40*	12	17.03	16.82
40-60*	353	7.96	7.1
61-80*	1445	9.44	7.55
81-180	6505	9.94	7.14
181-300	3277	10	8
301-350	366	9.63	7.48
351-400	117	9.58	7.58
>400	15	10.85	10.83

For glucose ranges ≤ 80 mg/dL, the differences in mg/dL are included instead of percent difference (%). **Note: Sensor glucose readings are within 40-400 mg/dL.*

Table 4: CGM Difference to CM within CM Glucose Ranges, Calibrating three to four times per day, Abdominal Insertion Site

CM Glucose Ranges (mg/dL)	Number of Paired CGM-CM Points	Mean Absolute Percent Difference (%)	Median Absolute Percent Difference (%)
Overall	11664	9.64	7.08
<40*	11	16.41	15.05
40-60*	324	7.53	6.6
61-80*	1403	8.81	6.75
81-180	6342	9.33	6.62
181-300	3114	8.57	6.98
301-350	341	8.13	6.26
351-400	114	8.56	7.15
>400	15	10.92	10.83

**For glucose ranges ≤ 80 mg/dL, the differences in mg/dL are included instead of percent difference (%).*
***Note:** Sensor glucose readings are within 40-400 mg/dL.*

Table 5. CGM Difference to CM within Reference Glucose Range, Calibrating Every 12 hours, Arm Insertion Site.

CM Glucose Ranges (mg/dL)	Number of Paired CGM-CM Points	Mean Absolute Relative Difference (%) (MARD)	Median Absolute Relative Difference (%) (ARD)
Overall	10526	9.09	6.88
<40*	7	17.24	16.05
40-60*	335	6.44	5.4
61-80*	1345	7.76	5.65
81-180	5644	8.64	6.42
181-300	2766	8.58	7
301-350	308	9.09	7.51
351-400	111	8.47	6.92
>400	10	10.71	10.44

** For glucose range ≤ 80 mg/dL, the differences in mg/dL are included instead of percent difference (%).*
***Note:** Sensor glucose readings are within 40-400 mg/dL.*

Table 6. CGM Difference to CM within CM Glucose Ranges, Calibrating three to four times per day, Arm Insertion Site

CM Glucose Ranges (mg/dL)	Number of Paired CGM-CM Points	Mean Absolute Relative Difference (%)	Median Absolute Relative Difference (%)
Overall	10771	8.68	6.67
<40*	7	17.24	16.05
40-60*	349	6.42	5.45
61-80*	1372	7.44	5.3
81-180	5795	8.35	6.3
181-300	2785	7.95	6.71
301-350	338	8.27	6.88
351-400	115	8.23	6.76
>400	10	11.44	10.44

** For glucose range ≤ 80 mg/dL, the differences in mg/dL are included instead of percent difference (%).*
***Note:** Sensor glucose readings are within 40-400 mg/dL.*

Tables 7 to 10 provide the Guardian sensor values and the percent of data points that fell within 15, 20, 30, 40, and >40 mg/dL or percent of a specific glucose CM range when the sensor was calibrated every 12 hours and when the sensor was calibrated three to four times per day, for senors inserted in the abdomen and upper arm locations, respectively.

Table 7: Agreement (%) of Sensor-CM Paired Points (15/15%- greater than 40/40%) Stratified by Different CM Glucose Ranges, Calibrated every 12 hours, Abdominal Insertion Site

CGM Glucose Ranges (mg/dL)	Number of CGM-CM	Percent of CM Within 15/15% of CGM	Percent of CM Within 20/20% of CGM	Percent of CM Within 30/30% of CGM	Percent of CM Within 40/40% of CGM	Percent of CM Greater Than 40/40% of CGM
Overall	12090	76.6	85.7	94.3	97.3	2.7
>=40-60*	781	57.7	73.2	90.7	96.9	3.1
>60-80*	1350	76.1	83.4	93.4	96.8	3.2
>80-180	6769	76.5	85.3	93.5	96.5	3.5
>180-300	2833	80.8	90	97.1	98.9	1.1
>300-350	286	86.4	95.1	99.7	100	0
>350-400	71	93	100	100	100	0

**For glucose ranges ≤ 80 mg/dL, agreement was based on 15/20/30/40 mg/dL.*
***Note:** Sensor glucose readings are within 40-400 mg/dL*

Table 8: Agreement (%) of Sensor-CM Paired Points (15/15%-greater than 40/40%) Stratified by Different CM Glucose Ranges, Calibrated three to four times per day, Abdominal Insertion Site

CGM Glucose Ranges (mg/dL)	Number of CGM-CM	Percent of CM Within 15/15% of CGM	Percent of CM Within 20/20% of CGM	Percent of CM Within 30/30% of CGM	Percent of CM Within 40/40% of CGM	Percent of CM Greater Than 40/40% of CGM
Overall	11664	80.6	88.9	95.9	98.2	1.8
>=40-60*	686	60.2	75.1	92	98.1	1.9
>60-80*	1303	78.7	85.7	93.5	96.7	3.3
>80-180	6549	79.9	88.5	95.7	98	2
>180-300	2782	86.4	93.5	98	99.4	0.6
>300-350	279	92.5	97.8	99.6	100	0
>350-400	65	95.4	100	100	100	0

**For glucose ranges ≤ 80 mg/dL, agreement was based on 15/20/30/40 mg/dL.*
Note: *Sensor glucose readings are within 40-400 mg/dL*

Table 9: Agreement (%) of Sensor-CM Paired Points (15/15%- greater than 40/40%) Stratified by Different CM Glucose Ranges, Calibrated Every 12 hours, Arm Insertion Site

CGM Glucose Ranges (mg/dL)	Number of CGM-CM	Percent of CM Within 15/15% of CGM	Percent of CM Within 20/20% of CGM	Percent of CM Within 30/30% of CGM	Percent of CM Within 40/40% of CGM	Percent of CM Greater Than 40/40% of CGM
Overall	10526	82.5	90.3	96.3	98.7	1.3
>=40-60*	520	77.1	86.9	96	99.6	0.4
>60-80*	1238	88.2	92.5	96.4	99	1
>80-180	5957	80.3	88.5	95.5	98.2	1.8
>180-300	2495	85	93.2	98	99.4	0.6
>300-350	256	90.6	96.9	100	100	0
>350-400	60	90	93.3	100	100	0

**For glucose ranges ≤ 80 mg/dL, agreement was based on 15/20/30/40 mg/dL.*
Note: *Sensor glucose readings are within 40-400 mg/dL*

Table 10: Agreement (%) of Sensor-CM Paired Points (15/15%-greater than 40/40%) Stratified by Different CM Glucose Ranges, Calibrated three to four times per day, Arm Insertion Site

CGM Glucose Ranges (mg/dL)	Number of CGM-CM	Percent of CM Within 15/15% of CGM	Percent of CM Within 20/20% of CGM	Percent of CM Within 30/30% of CGM	Percent of CM Within 40/40% of CGM	Percent of CM Greater Than 40/40% of CGM
Overall	10771	84.3	91.6	97.3	99.1	0.9
>=40-60*	503	77.1	87.5	96.6	99.6	0.4
>60-80*	1291	89.3	93.4	97.7	99.1	0.9
>80-180	6076	82	90	96.7	98.7	1.3
>180-300	2569	87	94.4	98.3	99.7	0.3
>300-350	271	94.8	98.5	100	100	0
>350-400	61	95.1	96.7	100	100	0

**For glucose ranges ≤ 80 mg/dL, agreement was based on 15/20/30/40 mg/dL.*
***Note:** Sensor glucose readings are within 40-400 mg/dL*

Tables 11 to 14 provide the number and percentage of CM measurements collected while the continuous glucose monitor read 'low' (< 40 mg/dL), or 'high' (> 400 mg/dL) for sensors calibrated every 12 hours and three to four times per day.

Table 11: The Number and Percentage of CM values collected when CGM readings displayed 'Low' (less than 40 mg/dL); Calibrating Every 12 hours, Abdominal and arm insertion sites

CGM Readings	Insertion Site	CGM-CM pairs	<55	<60	<70	<80	>80	Total
'LOW'	Abdomen	Cumulative, n	42	77	139	150	4	154
		Cumulative %	27%	50%	90%	97%	3%	-
	Arm	Cumulative, n	17	35	67	74	1	75
		Cumulative %	23%	47%	89%	99%	1%	-

Table 12: The Number and Percentage of CM values collected when CGM readings displayed 'High' (more than 400 mg/dL); calibrating every 12 hours, Abdominal and arm insertion sites

CGM Readings	Insertion Site	CGM-CM pairs	>340	>320	>280	>240	<240	Total
'HIGH'	Abdomen	Cumulative, n	8	9	9	9	0	9
		Cumulative, %	89%	100%	100%	100%	0%	-
	Arm	Cumulative, n	8	8	9	9	0	9
		Cumulative, %	89%	89%	100%	100%	0%	-

Table 13: The Number and Percentage of CM values collected when CGM readings displayed 'Low' (less than 40 mg/dL); calibrating three to four times per day, Abdominal and arm insertion sites

CGM Readings	Insertion Site	CGM-CM pairs	<55	<60	<70	<80	>80	Total
'LOW'	Abdomen	Cumulative, n	33	64	108	119	4	123
		Cumulative, %	27%	52%	88%	97%	3%	-
	Arm	Cumulative, n	18	35	66	72	1	73
		Cumulative, %	25%	48%	90%	99%	1%	-

Table 14: The Number and Percentage of CM values collected when CGM readings displayed 'High' (more than 400 mg/dL); calibrating three to four times per day, Abdominal and arm insertion sites

CGM Readings	Insertion Site	CGM-CM pairs	>340	>320	>280	>240	<240	Total
'HIGH'	Abdomen	Cumulative, n	8	9	9	9	0	9
		Cumulative, %	89%	100%	100%	100%	0%	-
	Arm	Cumulative, n	8	8	8	8	0	8
		Cumulative, %	100%	100%	100%	100%	0%	-

Tables 15 through 18 show the percentage of concurring CGM readings compared to CM values. Tables 21 and 22 show the concurrence of the CGM values compared to CM values when calibrating every 12 hours, and when calibrating every three to four hours, respectively. With ideal performance, the CGM readings would match the CM values. For example, with perfect concurrence, the shaded boxes would be 100 percent.

Table 15: Concurrence of CM Values and CGM Readings Using CM Glucose Ranges; Calibrating Every 12 Hours, Abdominal Insertion Site

CGM Reference Glucose Ranges (mg/dL)	Percent of Matched Pairs in Each CM Glucose Range for Each CGM Glucose Range											
	CM (mg/dL)											
	Number of Paired CGM-CM points	<40	>=40-60	>60-80	>80-120	>120-160	>160-200	>200-250	>250-300	>300-350	>350-400	>400
A) <40	154	0.0% (0/0)	50.0% (77/154)	47.4% (73/154)	2.6% (4/154)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)
B) >=40-60	781	1.2% (9/781)	30.7% (240/781)	57.2% (447/781)	10.6% (83/781)	0.3% (2/781)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)
C) >60-80	1350	0.2% (3/1350)	8.3% (112/1350)	60.1% (811/1350)	29.2% (394/1350)	2.1% (28/1350)	0.1% (2/1350)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)
D) >80-120	2953	0.0% (0/0)	0.0% (1/2953)	6.3% (185/2953)	73.0% (2157/2953)	18.2% (537/2953)	2.0% (60/2953)	0.4% (13/2953)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)
E) >120-160	2784	0.0% (0/0)	0.0% (0/0)	0.1% (2/2784)	8.8% (245/2784)	67.7% (1885/2784)	20.3% (565/2784)	2.8% (79/2784)	0.3% (8/2784)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)
F) >160-200	1875	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.1% (2/1875)	10.0% (188/1875)	60.2% (1128/1875)	28.2% (529/1875)	1.5% (28/1875)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)
G) >200-250	1382	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.3% (4/1382)	8.0% (111/1382)	61.1% (844/1382)	28.1% (389/1382)	2.3% (32/1382)	0.1% (2/1382)	0.0% (0/0)
H) >250-300	608	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.3% (2/608)	10.9% (66/608)	61.2% (372/608)	25.5% (155/608)	2.1% (13/608)	0.0% (0/0)
I) >300-350	286	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	1.0% (3/286)	19.9% (57/286)	55.2% (158/286)	22.4% (64/286)	1.4% (4/286)
J) >350-400	71	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	1.4% (1/71)	29.6% (21/71)	53.5% (38/71)	15.5% (11/71)
K) >400	9	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	11.1% (1/9)	77.8% (7/9)	11.1% (1/9)

Table 16: Concurrence of CM Values and CGM Readings Using CM Glucose Ranges; Calibrating 3 to 4 Times per Day, Abdominal Insertion Site

CGM Reference Glucose Ranges (mg/dL)	Percent of Matched Pairs-in Each CM Glucose Range for Each CGM Glucose Range											
	CM (mg/dL)											
	Number of Paired CGM-CM Points	**<40**	**>=40-60**	**>60-80**	**>80-120**	**>120-160**	**>160-200**	**>200-250**	**>250-300**	**>300-350**	**>350-400**	**>400**
A) <40	123	0.0% (0/0)	52.0% (64/123)	44.7% (55/123)	3.3% (4/123)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)
B) >=40-60	686	1.3% (9/686)	31.6% (217/686)	57.0% (391/686)	9.9% (68/686)	0.1% (1/686)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)
C) >60-80	1303	0.2% (2/1303)	8.1% (106/1303)	63.4% (826/1303)	26.2% (342/1303)	1.9% (25/1303)	0.2% (2/1303)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)
D) >80-120	2864	0.0% (0/0)	0.0% (1/2864)	6.5% (186/2864)	74.5% (2133/2864)	17.5% (502/2864)	1.3% (36/2864)	0.2% (6/2864)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)
E) >120-160	2681	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	9.0% (241/2681)	69.9% (1874/2681)	19.1% (512/2681)	1.8% (49/2681)	0.2% (5/2681)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)
F) >160-200	1820	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.1% (2/1820)	10.3% (188/1820)	63.6% (1157/1820)	24.9% (454/1820)	1.0% (19/1820)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)
G) >200-250	1314	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.5% (7/1314)	8.5% (112/1314)	65.3% (858/1314)	24.6% (323/1314)	1.1% (14/1314)	0.0% (0/0)	0.0% (0/0)
H) >250-300	652	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.3% (2/652)	11.3% (74/652)	63.5% (414/652)	22.9% (149/652)	2.0% (13/652)	0.0% (0/0)
I) >300-350	279	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	17.9% (50/279)	59.5% (166/279)	21.1% (59/279)	1.4% (4/279)
J) >350-400	65	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	18.5% (12/65)	64.6% (42/65)	16.9% (11/65)
K) >400	9	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	11.1% (1/9)	77.8% (7/9)	11.1% (1/9)

Table 17: Concurrence of CM Values and CGM Readings Using CM Glucose Ranges; Calibrating Every 12 Hours, Arm Insertion Site

CGM Reference Glucose Ranges (mg/dL)	Percent of Matched Pairs-in Each CM Glucose Range for Each CGM Glucose Range											
	CM (mg/dL)											
	Number of Paired CGM-CM Points	**<40**	**>=40-60**	**>60-80**	**>80-120**	**>120-160**	**>160-200**	**>200-250**	**>250-300**	**>300-350**	**>350-400**	**>400**
A) <40	75	2.7% (2/75)	44.0% (33/75)	52.0% (39/75)	1.3% (1/75)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)
B) >=40-60	520	1.0% (5/520)	41.9% (218/520)	51.7% (269/520)	5.4% (28/520)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)
C) >60-80	1238	0.2% (2/1238)	9.2% (114/1238)	70.3% (870/1238)	20.0% (247/1238)	0.4% (5/1238)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)
D) >80-120	2722	0.0% (0/0)	0.1% (3/2722)	7.5% (203/2722)	74.0% (2014/2722)	17.7% (481/2722)	0.8% (21/2722)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)
E) >120-160	2348	0.0% (0/0)	0.0% (0/0)	0.1% (3/2348)	9.2% (215/2348)	70.4% (1652/2348)	18.0% (423/2348)	2.3% (54/2348)	0.0% (1/2348)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)
F) >160-200	1614	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.1% (2/1614)	9.4% (151/1614)	64.7% (1044/1614)	24.8% (400/1614)	0.9% (14/1614)	0.2% (3/1614)	0.0% (0/0)	0.0% (0/0)
G) >200-250	1212	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.6% (7/1212)	6.8% (83/1212)	63.9% (774/1212)	27.3% (331/1212)	1.4% (17/1212)	0.0% (0/0)	0.0% (0/0)
H) >250-300	556	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.2% (1/556)	9.4% (52/556)	65.1% (362/556)	23.9% (133/556)	1.4% (8/556)	0.0% (0/0)
I) >300-350	256	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	18.0% (46/256)	56.6% (145/256)	24.6% (63/256)	0.8% (2/256)
J) >350-400	60	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	3.3% (2/60)	16.7% (10/60)	66.7% (40/60)	13.3% (8/60)
K) >400	9	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	11.1% (1/9)	55.6% (5/9)	33.3% (3/9)

Table 18: Concurrence of CM Values and CGM Readings Using CM Glucose Ranges; Calibrating 3 to 4 Times per Day, Arm Insertion Site

CGM Reference Glucose Ranges (mg/dL)	Percent of Matched Pairs-in Each CM Glucose Range for Each CGM Glucose Range											
	CM (mg/dL)											
	Number of Paired CGM-CM Points	**<40**	**>=40-60**	**>60-80**	**>80-120**	**>120-160**	**>160-200**	**>200-250**	**>250-300**	**>300-350**	**>350-400**	**>400**
A) <40	73	2.7% (2/73)	45.2% (33/73)	50.7% (37/73)	1.4% (1/73)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)
B) >=40-60	503	1.0% (5/503)	45.9% (231/503)	48.3% (243/503)	4.8% (24/503)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)
C) >60-80	1291	0.2% (2/1291)	8.9% (115/1291)	72.3% (933/1291)	18.4% (237/1291)	0.3% (4/1291)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)
D) >80-120	2756	0.0% (0/0)	0.1% (3/2756)	7.0% (194/2756)	75.9% (2092/2756)	16.5% (456/2756)	0.4% (11/2756)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)
E) >120-160	2442	0.0% (0/0)	0.0% (0/0)	0.1% (2/2442)	9.3% (228/2442)	71.4% (1743/2442)	18.0% (439/2442)	1.2% (30/2442)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)
F) >160-200	1588	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.1% (2/1588)	9.4% (150/1588)	66.3% (1053/1588)	23.5% (373/1588)	0.6% (9/1588)	0.1% (1/1588)	0.0% (0/0)	0.0% (0/0)
G) >200-250	1246	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.5% (6/1246)	7.4% (92/1246)	65.7% (818/1246)	25.1% (313/1246)	1.4% (17/1246)	0.0% (0/0)	0.0% (0/0)
H) >250-300	613	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.2% (1/613)	8.6% (53/613)	65.1% (399/613)	24.6% (151/613)	1.5% (9/613)	0.0% (0/0)
I) >300-350	271	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	16.2% (44/271)	59.8% (162/271)	23.2% (63/271)	0.7% (2/271)
J) >350-400	61	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	4.9% (3/61)	11.5% (7/61)	70.5% (43/61)	13.1% (8/61)
K) >400	8	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	62.5% (5/8)	37.5% (3/8)

Tables 19 to 22 show the sensor stability by comparing the CM values collected during frequent sample testing days 1, 3, and 7 to their paired sensor points. The tables stratify the paired CM-sensor data by agreement rates within 15/20/30/40 mg/dL for glucose values ≤ 80 mg/dL, or within 15%/20%/30%/40% for glucose values > 80 mg/dL, respectively.

Table 19: Sensor Stability (accuracy over time) for Calibration Every 12 Hours. Abdomen Insertion

Day of Wear	Numbe of Paired CGM-CM Points	Mean absolute percent difference (%)	Median absolute percent difference (%)	Percent within 15/15% CM	Percent within 20/20% CM	Percent within 30/30% CM	Percent within 40/40% CM	Percent greater than 40/40% CM
1	**4294**	13.0	10.2	68.3	81	93.1	97.9	2.1
3	4533	8.9	6.9	86.6	93.8	98.2	99.5	0.5
7	3263	9.5	6.8	81.9	90.1	97	99.2	0.8

**For glucose ranges ≤ 80 mg/dL, agreement was based on 15/20/30/40 mg/dL.*

Table 20: Sensor Stability (accuracy over time) for Calibration Every 12 Hours. Arm Insertion

Days of Wear	Number of Paired CGM-CM Points	Mean Absolute Percent Difference	Median Absolute Percent Difference	Percent Within 15/15% CM	Percent Within 20/20% CM	Percent Within 30/30% CM	Percent Within 40/40% CM	Percent Greater Than 40/40% CM
1	3390	10.8	8.2	77.4	86.5	96.1	99.6	0.4
3	4243	8.1	6.5	89.0	95.7	99.3	99.7	0.3
7	2893	8.5	6.3	87.3	93.1	97.7	99.6	0.4

**For glucose ranges ≤ 80 mg/dL, agreement was based on 15/20/30/40 mg/dL.*

Table 21: Sensor Stability (accuracy over time) for Calibration 3 to 4 Times per Day. Abdomen Insertion

Day of Wear	Number of Paired CGM-CM Points	Mean Absolute Percent Difference (%)	Median Absolute Percent Difference (%)	Percent Within 15/15% CM	Percent Within 20/20% CM	Percent Within 30/30% CM	Percent Within 40/40% CM	Percent Greater Than 40/40% CM
1	4136	11.7	8.8	74.4	85.3	94.6	98.2	1.8
3	4378	8.3	6.3	88.3	94.8	98.6	99.7	0.3
7	3150	8.7	6.2	85.5	92.1	97.7	99.6	0.4

**For glucose ranges ≤ 80 mg/dL, agreement was based on 15/20/30/40 mg/dL.*

Table 22: Sensor Stability (accuracy over time) for Calibration 3 to 4 Times per Day. Arm Insertion

Days of Wear	Number of Paired CGM-CM Points	Mean Absolute Percent Difference (%)	Median Absolute Percent Difference (%)	Percent Within 15/15% CM	Percent Within 20/20% CM	Percent Within 30/30% CM	Percent Within 40/40% CM	Percent Greater Than 40/40% CM
1	3591	10.3	7.8	79.3	88.3	97.1	99.6	0.4
3	4198	7.8	6.3	90.6	96.5	99.3	99.7	0.3
7	2982	8.1	6.2	88.8	94.1	98.5	99.8	0.2

**For glucose ranges ≤ 80 mg/dL, agreement was based on 15/20/30/40 mg/dL.*

Tables 23 through 26 provide the percent agreement of Guardian Sensor (3) and comparator method (CM) within a specific time range after calibration. These tables show that the percent agreement within 15, 20, 30, 40, and >40 % mg/dL is highest from zero to two hours after calibration for sensors calibrated every 12 hours and three to four times per day, respectively.

Table 23: Agreement Rates for Every 2 Hour Period Post Calibration, Calibrating every 12 hours. Abdomen Insertion

Time After Calibration	Number of Paired CGM-CM Points	Percentage (%) Agreement				
		± 15% (± 15mg/dL)	± 20% (± 20mg/dL)	± 30% (± 30mg/dL)	± 40% (± 40mg/dL)	> ±40% (± 40mg/dL)
0–2 hours	2999	85	92.6	97.8	99.6	0.4
2–4 hours	2667	75.1	85.9	95.3	98.8	1.2
4–6 hours	2138	71.4	82	92.7	97.6	2.4
6–8 hours	1521	77.6	88.4	97	99.3	0.7
8–10 hours	1523	84.2	91.1	97.6	99.3	0.7
10–12 hours	1242	79.8	89.5	96.3	98.6	1.4

**For glucose ranges ≤ 80 mg/dL, agreement was based on 15/20/30/40 mg/dL.*

Table 24: Agreement Rates for Every 2 Hour Period Post Calibration, Calibrating every 12 hours. Arm Insertion

Time After Calibration	Nunber of Paired CGM-CM Points	Percentage (%) Agreement				
		± 15% (± 15 mg/dL)	± 20% (± 20 mg/dL)	± 30% (± 30 mg/dL)	± 40% (± 40 mg/dL)	> ±40% (± 40 mg/dL)
0–2 hours	2555	87.8	93.2	98.1	99.6	0.4
2–4 hours	2242	84.3	92.6	98.6	99.9	0.1
4–6 hours	1787	80.8	89.1	96.6	99.2	0.8
6–8 hours	1396	84.9	91.5	97.9	99.8	0.2
8–10 hours	1412	86	92.7	97.7	99.7	0.3
10–12 hours	1102	83.6	92.5	97.7	99.5	0.5

**For glucose ranges ≤ 80 mg/dL, agreement was based on 15/20/30/40 mg/dL.*

Table 25: Agreement Rates for Every 2 Hour Period Post Calibration, Calibrating three to four times per day. Abdomen Insertion

Time After Calibration	Number of Paired CGM-CM Points	Percentage (%) Agreement				
		± 15% (± 15 mg/dL)	± 20% (± 20 mg/dL)	± 30% (± 30 mg/dL)	± 40% (± 40 mg/dL)	> ±40% (± 40 mg/dL)
0-2 hours	4585	87	93.5	98.1	99.7	0.3
2-4 hours	3949	80.7	89.9	96.7	99	1
4-6 hours	2856	78.7	87.6	95.5	98.5	1.5
6-8 hours	227	74.9	86.3	96.9	99.6	0.4
8-10 hours	35	82.9	85.7	91.4	94.3	5.7
10-12 hours	12	91.7	91.7	91.7	100	0

**For glucose ranges ≤ 80 mg/dL, agreement was based on 15/20/30/40 mg/dL.*

Table 26: Agreement Rates for Every 2 Hour Period Post Calibration, Calibrating three to four times per day. Arm Insertion

CM Glucose Ranges (mg/dL)	Number of Paired CGM-CM Points	± 15% (± 15 mg/dL)	± 20% (± 20 mg/dL)	± 30% (± 30 mg/dL)	± 40% (± 40 mg/dL)	> ±40% (± 40 mg/dL)
0-2 hours	4156	89.2	94.3	98.5	99.8	0.2
2-4 hours	3640	86.3	93.6	98.8	99.8	0.2
4-6 hours	2684	82.6	90.7	97.4	99.3	0.7
6-8 hours	242	81	91.7	97.5	100	0
8-10 hours	39	76.9	94.9	97.4	100	0
10-12 hours	10	50	70	100	100	0

**For glucose ranges ≤ 80 mg/dL, agreement was based on 15/20/30/40 mg/dL.*

Tables 27 to 30 provide data to present sensor accuracy over specific glucose rates of change. These concurrence tables provide the percent of matched CM pairs to CGM values over specific glucose rates of change for sensors calibrated every 12 hours for the abdomen (Table 27) and the arm (Table 28) and three to four times per day for the abdomen (Table 29) and for the arm (Table 30).

Table 27: Concurrence of CGM and Comparator Method (CM) Rate of Change Stratified by Different CGM Rate Ranges. Calibration Every 12 hours. Abdomen Insertion

CGM Rate Ranges (mg/dL/min)	Percent of Matched Pairs in Each CM Rate Range for Each CGM Rate Range							
	CM Rate of Change (mg/dL/min)							
	Number of Paired CGM-CM Points	<-3	[-3, -2)	[-2, -1)	[-1, 1]	(1, 2]	(2, 3]	>3
≤ 3	27	25.9% (7/27)	22.2% (6/27)	25.9% (7/27)	22.2% (6/27)	3.7% (1/27)	0.0% (0/0)	0.0% (0/0)
[-3, -2)	135	5.9% (8/135)	30.4% (41/135)	43.0% (58/135)	20.7% (28/135)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)
[-2, -1)	1001	0.5% (5/1001)	4.3% (43/1001)	39.9% (399/1001	55.0% (551/1001)	0.3% (3/1001)	0.0% (0/0)	0.0% (0/0)
[-1, 1]	9477	0.2% (16/9477)	0.2% (21/9477)	2.6% (246/9477	92.7% (8781/9477	4.0% (375/9477	0.3% (29/9477)	0.1% (9/9477)
(1, 2]	1059	0.1% (1/1059)	0.0% (0/0)	0.4% (4/1059)	42.4% (449/1059)	48.6% (515/1059	7.6% (80/1059)	0.9% (10/1059)
(2, 3]	308	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	11.0% (34/308)	46.4% (143/308)	35.4% (109/308)	7.1% (22/308)
> 3	83	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	7.2% (6/83)	20.5% (17/83)	34.9% (29/83)	37.3% (31/83)

Table 28: Concurrence of CGM and Comparator Method (CM) Rate of Change Stratified by Different CGM Rate Ranges. Calibration Every 12 hours. Arm Insertion

CGM Rate Ranges (mg/dL/min)	Percent of Matched Pairs-in Each CM Rate Range for Each CGM Rate Range							
	CM (mg/dL/min)							
	Number of Paired CGM-CM Points	<-3	[-3, -2)	[-2, -1)	[-1, 1]	(1, 2]	(2, 3]	>3
<-3	22	31.8% (7/22)	40.9% (9/22)	13.6% (3/22)	13.6% (3/22)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)
[-3, -2)	92	5.4% (5/92)	30.4% (28/92)	48.9% (45/92)	15.2% (14/92)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)
[-2, -1)	893	0.4% (4/893)	4.5% (40/893)	39.3% (351/893)	55.7% (497/893)	0.1% (1/893)	0.0% (0/0)	0.0% (0/0)
[-1, 1]	8251	0.2% (15/8251)	0.1% (12/8251)	2.8% (229/8251)	92.9% (7664/8251)	3.6% (301/8251)	0.3% (22/8251)	0.1% (8/8251)
1, 2]	936	0.1% (1/936)	0.0% (0/0)	0.2% (2/936)	38.1% (357/936)	54.2% (507/936)	6.7% (63/936)	0.6% (6/936)
(2, 3]	269	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	8.9% (24/269)	44.2% (119/269)	39.8% (107/269)	7.1% (19/269)
>3	63	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	3.2% (2/63)	9.5% (6/63)	39.7% (25/63)	47.6% (30/63)

Table 29: Concurrence of CGM and Comparator Method (CM) Rate of Change Stratified by Different CGM Rate Ranges. Calibrating 3 to 4 Times per Day. Abdomen Insertion

CGM Rate Ranges (mg/dL/min)	Percent of Matched Pairs in Each CM Rate Range for Each CGM Rate Range							
	CM (mg/dL/min)							
	Number of Paired CGM-CM Points	<-3	[-3, -2)	[-2, -1)	[-1, 1]	(1, 2]	(2, 3]	>3
≤ 3	25	28.0% (7/25)	28.0% (7/25)	24.0% (6/25)	16.0% (4/25)	4.0% (1/25)	0.0% (0/0)	0.0% (0/0)
[−3, −2)	134	6.0% (8/134)	29.8% (40/134)	42.5% (57/134)	20.9% (28/134)	0.7% (1/134)	0.0% (0/0)	0.0% (0/0)
[−2, −1)	967	0.5% (5/967)	4.6% (44/967)	38.7% (374/967)	55.9% (541/967)	0.3% (3/967)	0.0% (0/0)	0.0% (0/0)
[−1, 1]	9140	0.2% (16/9140)	0.2% (20/9140)	2.7% (246/9140	92.6% (8462/9140	4.0% (375/9140	0.3% (26/9140)	0.1% (8/9140)
(1, 2]	1024	0.0% (0/0)	0.0% (0/0)	0.2% (2/1024)	43.8% (448/1024)	47.5% (486/1024	7.5% (77/1024)	1.1% (11/1024)
(2, 3]	302	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	11.3% (34/302)	47.7% (144/302)	35.1% (106/302)	6.0% (18/302)
> 3	72	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	6.9% (5/72)	22.2% (16/72)	38.9% (28/72)	31.9% (23/72)

Table 30: Concurrence of CGM and Comparator Method (CM) Rate of Change Stratified by Different CGM Rate Ranges. Calibrating 3 to 4 Times per Day. Arm Insertion

CGM Rate Ranges (mg/dL/min)	Percent of Matched Pairs-in Each CM Rate Range for Each CGM Rate Range							
	CM (mg/dL/min)							
	Number of Paired CGM-CM Points	<-3	[-3, -2)	[-2, -1)	[-1, 1]	(1, 2]	(2, 3]	>3
<-3	22	31.8% (7/22)	40.9% (9/22)	13.6% (3/22)	9.1% (2/22)	4.5% (1/22)	0.0% (0/0)	0.0% (0/0)
[−3, −2)	102	4.9% (5/102)	32.4% (33/102)	48.0% (49/102)	14.7% (15/102)	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)
[−2, −1)	933	0.4% (4/933)	4.2% (39/933)	40.1% (374/933)	55.0% (513/933)	0.2% (2/933)	0.0% (0/0)	0.1% (1/933)
[−1, 1]	8388	0.2% (15/8388)	0.1% (12/8388)	2.6% (220/8388)	93.1% (7811/8388)	3.6% (303/8388)	0.2% (20/8388)	0.1% (7/8388)
(1, 2]	972	0.1% (1/972)	0.0% (0/0)	0.1% (1/972)	39.9% (388/972)	52.3% (508/972)	7.0% (68/972)	0.6% (6/972)
(2, 3]	285	0.4% (1/285)	0.0% (0/0)	0.0% (0/0)	10.5% (30/285)	43.9% (125/285)	37.2% (106/285)	8.1% (23/285)
>3	69	0.0% (0/0)	0.0% (0/0)	0.0% (0/0)	4.3% (3/69)	13.0% (9/69)	42.0% (29/69)	40.6% (28/69)

Precision Analysis

Precision of the System was evaluated by comparing the results from two separate sensors worn (Abdomen vs. Arm) on the same subject at the same time. A total of 84 subjects provided 28,102 pairs of CGM measurements, with a mean Percent Absolute Relative Difference (PARD) during the study of 9.36% with a coefficient of variation (%CV) of 6.5%.

Alert performance

Alert performance was evaluated to obtain 'true alert' and 'false alert' rates, and 'correctly detected' and 'missed alert' rates. The descriptions and tables below describe the alert rate performance of the device within this clinical study:

True alert rates

The true alert rate is the rate at which the blood glucose value confirmed that the continuous glucose monitor alert was triggered correctly. For example:

- True Threshold Hypoglycemic alert rate alerted when the continuous glucose monitor read that the user was below the low threshold and the user's blood glucose was actually below that low threshold (within +/- 15 or 30 minutes of the alert)
- True Threshold Hyperglycemic alert rate alerted when the continuous glucose monitor read that the user was above the high threshold and the user's blood glucose was actually above that high threshold (within +/- 15 or 30 minutes of the alert)
- True Predictive Hypoglycemic alert rate alerted when the continuous glucose monitor predicted that the user would reach below the low threshold and the user's blood glucose was actually below that low threshold within 15 or 30 minutes following the alert
- True Predictive Hyperglycemic alert rate alerted when the continuous glucose monitor predicted that the user would reach above the high threshold and the user's blood glucose was actually above that high threshold within 15 or 30 minutes following the alert.

Table 31: Glucose TRUE Alert Performance Using Every 12 hours

	Threshold Only			Predictive Only			Threshold & Predictive		
	mg/dL	**30 min**	**15 min**	**mg/dL**	**30 min**	**15 min**	**mg/dL**	**30 min**	**15 min**
Glucose True Alert Rate: Low glucose Alerts, Abdomen	**50**	25.0%	25.0%	**50**	15.2%	12.3%	**50**	18.2%	16.2%
	60	53.5%	51.9%	**60**	40.7%	37.1%	**60**	46.2%	43.4%
	70	66.9%	66.9%	**70**	52.7%	47.7%	**70**	58.3%	55.2%
	80	69.3%	69.3%	**80**	57.8%	51.1%	**80**	62.2%	58.2%
	90	75.1%	74.4%	**90**	64.0%	58.5%	**90**	67.9%	64.3%
Glucose True Alert Rate: High glucose Alerts, Abdomen	**300**	81.3%	81.3%	**300**	57.8%	54.0%	**300**	65.4%	62.7%
	250	90.2%	90.2%	**250**	64.0%	60.1%	**250**	72.5%	69.8%
	220	91.9%	91.9%	**220**	68.9%	66.3%	**220**	76.6%	74.8%
	180	93.7%	92.8%	**180**	70.5%	66.9%	**180**	78.0%	75.4%
Glucose True Alert Rate: Low glucose Alerts, Arm	**50**	36.8%	36.8%	**50**	21.9%	16.7%	**50**	26.1%	22.4%
	60	69%	67.8%	**60**	47.5%	45.6%	**60**	55.1%	53.5%
	70	77.4%	75.3%	**70**	57.4%	54.5%	**70**	65.6%	63%
	80	77.5%	76.4%	**80**	59.9%	53%	**80**	66.5%	61.9%
	90	74.9%	74.9%	**90**	69%	63.2%	**90**	71.3%	68%
Glucose True Alert Rate: High glucose Alerts, Arm	**300**	81.9%	80.6%	**300**	51.7%	49.7%	**300**	61.2%	59.3%
	250	91.4%	91.4%	**250**	62%	59.8%	**250**	71.1%	69.6%
	220	92.2%	92.2%	**220**	65.7%	62.2%	**220**	74.5%	72.2%
	180	92.9%	92.9%	**180**	68%	63.2%	**180**	76.5%	73.7%

False Alert Rates

The glucose false alert rate is the rate at which the blood glucose value did not confirm that the continuous glucose monitor alert was triggered correctly. For example:

- False Threshold Hypoglycemic alert rate the alarm alerted when the continuous glucose monitor read that the user was below the low threshold but the users blood glucose was actually above that low threshold (within ± 15 or 30 minutes of the alert); or
- False Threshold Hyperglycemic alert rate the alarm alerted when the continuous glucose monitor read that the user was above the high threshold but the user's blood glucose was actually below that high threshold (within ± 15 or 30 minutes of the alert); or
- False Predictive Hypoglycemic alert rate the alarm alerted when the continuous glucose monitor predicted that the user would be below the low threshold but the user's blood glucose was actually above that low

threshold within 15 or 30 minutes following the alert.

- False Predictive Hyperglycemic alert rate the alarm alerted when the continuous glucose monitor predicted that the user would be above the high threshold but the user's blood glucose was actually below the high threshold within 15 or 30 minutes following the alert.

Table 32: Glucose FALSE Alert Performance Calibrating Every 12 hours

	Threshold Only			**Predictive Only**			**Threshold & Predictive**		
	mg/dL	**30 min**	**15 min**	**mg/dL**	**30 min**	**15 min**	**mg/dL**	**30 min**	**15 min**
Glucose False Alert Rate: Low Glucose Alerts, Abdomen	**50**	75.0%	75.0%	**50**	84.8%	87.7%	**50**	81.8%	83.8%
	60	46.5%	48.1%	**60**	59.3%	62.9%	**60**	53.8%	56.6%
	70	33.1%	33.1%	**70**	47.3%	52.3%	**70**	41.7%	44.8%
	80	30.7%	30.7%	**80**	42.2%	48.9%	**80**	37.8%	41.8%
	90	24.9%	25.6%	**90**	36.0%	41.5%	**90**	32.1%	35.7%
Glucose False Alert Rate: High Glucose Alerts, Abdomen	**300**	18.8%	18.8%	**300**	42.2%	46.0%	**300**	34.6%	37.3%
	250	9.80%	9.80%	**250**	36.0%	39.9%	**250**	27.5%	30.2%
	220	8.10%	8.10%	**220**	31.1%	33.7%	**220**	23.4%	25.2%
	180	6.30%	7.20%	**180**	29.5%	33.1%	**180**	22.0%	24.6%
Glucose False Alert Rate: Low Glucose Alerts, Arm	**50**	63.2%	63.2%	**50**	84.8%	87.7%	**50**	81.8%	83.8%
	60	31%	32.2%	**60**	59.3%	62.9%	**60**	53.8%	56.6%
	70	22.6%	24.7%	**70**	47.3%	52.3%	**70**	41.7%	44.8%
	80	22.5%	23.6%	**80**	42.2%	48.9%	**80**	37.8%	41.8%
	90	25.1%	25.1%	**90**	36.0%	41.5%	**90**	32.1%	35.7%
Glucose False Alert Rate: High Glucose Alerts, Arm	**300**	18.1%	19.4%	**300**	48.3%	50.3%	**300**	38.8%	40.7%
	250	8.6%	8.6%	**250**	38%	40.2%	**250**	28.9%	30.4%
	220	7.8%	7.8%	**220**	34.3%	37.8%	**220**	25.5%	27.8%
	180	7.1%	7.1%	**180**	32%	36.8%	**180**	23.5%	26.3%

Correct Detection Rates

Glucose Correct Detection Rate is the rate that the device alerted when it should have alerted. For example, the blood glucose was below the hypoglycemic threshold, or above the hyperglycemic threshold, and the device sounded an alert (within +/- 15 or 30 minutes for the threshold alerts, and within 15 or 30 minutes following predictive alerts).

Table 33: Glucose Correct Detection Alert Performance Calibrating Every 12 hours

	Threshold Only			**Predictive Only**			**Threshold & Predictive**		
	mg/dL	**30 min**	**15 min**	**mg/dL**	**30 min**	**15 min**	**mg/dL**	**30 min**	**15 min**
Glucose Correct Detection Rate: Low Glucose Alerts, Abdomen	**50**	64.0%	64.0%	**50**	76.0%	68.0%	**50**	76.0%	68.0%
	60	83.3%	82.1%	**60**	94.0%	88.1%	**60**	94.0%	89.3%
	70	90.5%	90.5%	**70**	94.2%	89.8%	**70**	94.2%	92.0%
	80	87.2%	87.2%	**80**	93.6%	87.2%	**80**	93.6%	89.9%
	90	91.1%	88.7%	**90**	94.6%	89.5%	**90**	95.7%	92.2%
Glucose Correct Detection Rate: High Glucose Alerts,	**300**	75.3%	75.3%	**300**	95.3%	92.9%	**300**	95.3%	94.1%
	250	81.5%	80.9%	**250**	96.5%	91.3%	**250**	96.5%	93.6%
	220	90.1%	89.2%	**220**	94.8%	93.5%	**220**	95.3%	94.4%
	180	93.1%	91.4%	**180**	96.6%	93.4%	**180**	96.9%	95.4%
Glucose Correct Detection Rate: Low Glucose Alerts, Arm	**50**	66.7%	66.7%	**50**	95.2%	71.4%	**50**	95.2%	76.2%
	60	86.3%	83.6%	**60**	98.6%	94.5%	**60**	98.6%	97.3%
	70	90.2%	88.6%	**70**	92.7%	90.2%	**70**	93.5%	91.9%
	80	89%	88.4%	**80**	94.8%	86.6%	**80**	95.9%	92.4%
	90	91.7%	90.4%	**90**	96.9%	91.7%	**90**	97.8%	95.6%
Glucose Correct Detection Rate: High Glucose Alerts, Arm	**300**	74.4%	71.8%	**300**	93.6%	89.7%	**300**	93.6%	89.7%
	250	80.9%	79.6%	**250**	96.7%	90.8%	**250**	96.7%	91.4%
	220	90.1%	89.2%	**220**	96.1%	93.6%	**220**	96.1%	95.6%
	180	93.2%	92.2%	**180**	98.1%	94.2%	**180**	98.7%	96.4%

Missed Detection Rates

The Missed Detection Rate is the rate that the device did not alert when it should have (within +/- 15 or 30 minutes for the threshold alerts, and within 15 or 30 minutes following predictive alerts). For example, the blood glucose was below the hypoglycemic threshold, or above the hyperglycemic threshold, and the device did not sound a threshold or predictive alert.

Table 34: Glucose Missed Detection Alert Performance Calibrating Every 12 hours

	Threshold Only			Predictive Only			Threshold & Predictive		
	mg/dL	**30 min**	**15 min**	**mg/dL**	**30 min**	**15 min**	**mg/dL**	**30 min**	**15 min**
Glucose Missed Detection Rate: Low Glucose Alerts, Abdomen	**50**	36.0%	36.0%	**50**	24.0%	32.0%	**50**	24.0%	32.0%
	60	16.7%	17.9%	**60**	6.0%	11.9%	**60**	6.0%	10.7%
	70	9.5%	9.5%	**70**	5.8%	10.2%	**70**	5.8%	8.0%
	80	12.8%	12.8%	**80**	6.4%	12.8%	**80**	6.4%	10.1%
	90	8.9%	11.3%	**90**	5.4%	10.5%	**90**	4.3%	7.8%
Glucose Missed Detection Rate: High Glucose Alerts, Abdomen	**300**	24.7%	24.7%	**300**	4.7%	7.1%	**300**	4.7%	5.9%
	250	18.5%	19.1%	**250**	3.5%	8.7%	**250**	3.5%	6.4%
	220	9.9%	10.8%	**220**	5.2%	6.5%	**220**	4.7%	5.6%
	180	6.9%	8.6%	**180**	3.4%	6.6%	**180**	3.1%	4.6%
Glucose Missed Detection Rate: Low Glucose Alerts, Arm	**50**	33.3%	33.3%	**50**	4.8%	28.6%	**50**	4.8%	23.8%
	60	13.7%	16.4%	**60**	1.4%	5.5%	**60**	1.4%	2.7%
	70	9.8%	11.4%	**70**	7.3%	9.8%	**70**	6.5%	8.1%
	80	11%	11.6%	**80**	5.2%	13.4%	**80**	4.1%	7.6%
	90	8.3%	9.6%	**90**	3.1%	8.3%	**90**	2.2%	4.4%
Glucose Missed Detection Rate: High Glucose Alerts, Arm	**300**	25.6%	28.2%	**300**	6.4%	10.3%	**300**	6.4%	10.3%
	250	19.1%	20.4%	**250**	3.3%	9.2%	**250**	3.3%	8.6%
	220	9.9%	10.8%	**220**	3.9%	6.4%	**220**	3.9%	4.4%
	180	6.8%	7.8%	**180**	1.9%	5.8%	**180**	1.3%	3.6%

3. Subgroup Analyses

The following preoperative characteristics were evaluated for potential association with outcomes:

Guardian sensor performance was evaluated withinstudy population subgroups, such as the frequent sampling participation group, age(14-21 years

old, 22 years old and above), body mass index (BMI), baseline HbA1c, prior continuous glucose monitor experience, prior pump experience, and exercise activity (during in-clinic portions of the study).

Although the studies were not powered for analysis of subpopulations, no significant differences in performance were noted based on these subgroup analyses.

4. Pediatric Extrapolation

The sponsor provided clinical data in pediatric subjects aged 14 and up. In this premarket application, existing clinical data was not leveraged to support approval of a pediatric patient population younger than 14 years old. This device is approved for use in persons aged 14 and older.

E. Financial Disclosure

The Financial Disclosure by Clinical Investigators regulation (21 CFR 54) requires applicants who submit a marketing application to include certain information concerning the compensation to, and financial interests and arrangement of, any clinical investigator conducting clinical studies covered by the regulation. The pivotal clinical study included 6 investigators. None of the clinical investigators had disclosable financial interests/arrangements as defined in sections 54.2(a), (b), (c), and (f). The information provided does not raise any questions about the reliability of the data.

XI. SUMMARY OF SUPPLEMENTAL CLINICAL INFORMATION

Please see the SSED for P150001 for descriptions of the supplemental clinical information relevant to the MiniMed 630G system.

XII. PANEL MEETING RECOMMENDATION AND FDA'S POST-PANEL ACTION

This PMA was not reviewed by an advisory panel because FDA had the experience and breadth of knowledge to evaluate safety and effectiveness.

XIII. CONCLUSIONS DRAWN FROM PRECLINICAL AND CLINICAL STUDIES

A. Effectiveness Conclusions

The effectiveness of the Guardian sensor component was based on the performance evaluation of the Guardian Sensor compared to the blood glucose values measured by the CM during in-clinic sessions spanning the wear period of the sensor (7 days). The performance data presented above (Tables 3 to 34) established the sensor performanceacross the claimed measuring range (40 to 400 mg/dL glucose), the precision, and thecalibration frequency (calibrate minimally every 12 hours or 3-4

times a day) of the 7-day wear period for the Guardian sensor in the abdomen and the arm. The performance data presented above also established the performance of the alarms and alerts of the Guardian sensor.

The results of the clinical studies performed to support approval establish a reasonable assurance that the Guardian Sensor (3) is effective for its intended use in the abdomen and the arm.

B. Safety Conclusions

The risks of the device are based on data collected in a clinical study conducted to support PMA approval as described above. The Guardian Sensor (3) has been approved to be use in the abdomen as a part of the MiniMed 670G System. There are no additional risks associated with the use of the Guardian Sensor (3) in the arm.

C. Benefit-Risk Determination

Summary of Benefits:

The probable benefits of the device are also based on data collected in a clinical study conducted to support PMA approval as described above and in the SSED for P150001.

The additional arm insertion site is beneficial to patients, given that the the MiniMed 630G System is intended for chronic use, and the Guardian Sensor (3) should be replaced every 7 days. The additional arm insertion site provides patients with an additional option for sensor insertion. The performance of the sensor (described in Section X.d, Safety and Effectiveness Results, above) at the arm insertion site is at least comparable to the performance of the sensor at the abdomen insertion site.

The benefits of the MiniMed 630G System otherwise remain unchanged from P150001.

Summary of Risks:

The additional arm insertion site is not expected to pose additional risks that translate to harm to patients, given that the performance of the sensor (described in Section X.d, Safety and Effectiveness Results, above) at the arm insertion site is at least comparable to the performance of the sensor at the abdomen insertion site.

The predictive and combined (predictive and threshold) alert performance at the arm insertion site for high sensor glucose values (180 mg/dL, 220 mg/dL, 250 mg /dL and 300 mg/dL) at both +/-15 minutes and +/-30 minutes is reported to be slightly inferior to the reported alert performance for the respective alerts at the abdomen insertion site. Lower true alert rates, higher false alert rates, lower correct detection, and higher missed detection rates are reported for the arm insertion site compared to the abdomen insertion site. Given the relatively small magnitude of the reported

difference in alert performance, as well as the nature of the alert ("hyper" and "predictive component" intrinsically carry less clinical risk than a "hypo" alert), and the comparability of other measures of sensor performance (including % agreement with the comparator method, concurrence between CGM and the comparator method at various glucose ranges), there do not appear to be additional questions of safety or effectiveness that arise as a result of this discrepancy in alert performance. However, there is an increased risk of "alert fatigue," that could result in potential inconvenience to the user, but should not translate into risk of harm to the patient.

The possible need for assistance with sensor insertion specific to the arm insertion site, is sufficiently conveyed through labeling.

The risks of the MiniMed 630G System otherwise remain unchanged from P150001.

Summary of Other Factors

Additional factors to be considered in determining probable risks and benefits for the MiniMed 630G System included sensor precision. Although sensor precision between the two arm insertion sites was not obtained during the pivotal study, the sponsor has provided information that supports the precision is comparable between arm versus arm insertion site compared to abdomen versus abdomen insertion site.

Patient Perspectives

Patient perspectives considered during the review included information provided directly to the Agency by patients in written statements and also obtained through discussion with patients at public forums regarding their experience with continuous glucose monitoring system devices in general.

In conclusion, given the available information above, the data support that for continuous delivery of basal insulin (at user selected rates) and administration of insulin boluses (in user selectable amounts) for the management of diabetes mellitus in persons fourteen years of age and older requiring insulin, as well as for the continuous monitoring and trending of glucose levels in the fluid under the skin, the probable benefits outweigh the probable risks.

D. Overall Conclusions

The data in this application support the reasonable assurance of safety and effectiveness of this device when used in accordance with the indications for use. The benefits of using the Guardian Sensor (3), inserted in the abdomen or the arm, with the MiniMed 630G System, as discussed above, outweigh the risks.

XIV. CDRH DECISION

CDRH issued an approval order on February 13, 2018.

The applicant's manufacturing facilities have been inspected and found to be in compliance with the device Quality System (QS) regulation (21 CFR 820).

XV. APPROVAL SPECIFICATIONS

Directions for use: See device labeling.

Hazards to Health from Use of the Device: See Indications, Contraindications, Warnings, Precautions, and Adverse Events in the device labeling.

Post-approval Requirements and Restrictions: See approval order.

XVI. REFERENCES

None.