October 27, 2023

Abbott Point of Care, Inc.
Brian Ma, Ph.D.
Principal Specialist, Regulatory Affairs
400 College Road East
Princeton, New Jersey 08540

Re: K230300
Trade/Device Name: i-STAT CG8+ cartridge with the i-STAT 1 System
Regulation Number: 21 CFR 862.1145
Regulation Name: Calcium Test System
Regulatory Class: Class II
Product Code: JFP, JPI
Dated: September 28, 2023
Received: September 29, 2023

Dear Brian Ma:

We have reviewed your section 510(k) premarket notification of intent to market the device referenced above and have determined the device is substantially equivalent (for the indications for use stated in the enclosure) to legally marketed predicate devices marketed in interstate commerce prior to May 28, 1976, the enactment date of the Medical Device Amendments, or to devices that have been reclassified in accordance with the provisions of the Federal Food, Drug, and Cosmetic Act (the Act) that do not require approval of a premarket approval application (PMA). You may, therefore, market the device, subject to the general controls provisions of the Act. Although this letter refers to your product as a device, please be aware that some cleared products may instead be combination products. The 510(k) Premarket Notification Database available at https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfpmn/pmn.cfm identifies combination product submissions. The general controls provisions of the Act include requirements for annual registration, listing of devices, good manufacturing practice, labeling, and prohibitions against misbranding and adulteration. Please note: CDRH does not evaluate information related to contract liability warranties. We remind you, however, that device labeling must be truthful and not misleading.

If your device is classified (see above) into either class II (Special Controls) or class III (PMA), it may be subject to additional controls. Existing major regulations affecting your device can be found in the Code of Federal Regulations, Title 21, Parts 800 to 898. In addition, FDA may publish further announcements concerning your device in the Federal Register.

Additional information about changes that may require a new premarket notification are provided in the FDA guidance documents entitled "Deciding When to Submit a 510(k) for a Change to an Existing Device" (https://www.fda.gov/media/99812/download) and "Deciding When to Submit a 510(k) for a Software Change to an Existing Device" (https://www.fda.gov/media/99785/download).

Your device is also subject to, among other requirements, the Quality System (QS) regulation (21 CFR Part 820), which includes, but is not limited to, 21 CFR 820.30, Design controls; 21 CFR 820.90, Nonconforming product; and 21 CFR 820.100, Corrective and preventive action. Please note that regardless of whether a change requires premarket review, the QS regulation requires device manufacturers to review and approve changes to device design and production (21 CFR 820.30 and 21 CFR 820.70) and document changes and approvals in the device master record (21 CFR 820.181).

Please be advised that FDA's issuance of a substantial equivalence determination does not mean that FDA has made a determination that your device complies with other requirements of the Act or any Federal statutes and regulations administered by other Federal agencies. You must comply with all the Act's requirements, including, but not limited to: registration and listing (21 CFR Part 807); labeling (21 CFR Part 801 and Part 809); medical device reporting (reporting of medical device-related adverse events) (21 CFR Part 803) for devices or postmarketing safety reporting (21 CFR Part 4, Subpart B) for combination products (see https://www.fda.gov/combination-products/guidance-regulatory-information/postmarketing-safety-reporting-combination-products); good manufacturing practice requirements as set forth in the quality systems (QS) regulation (21 CFR Part 820) for devices or current good manufacturing practices (21 CFR Part 4, Subpart A) for combination products; and, if applicable, the electronic product radiation control provisions (Sections 531-542 of the Act); 21 CFR Parts 1000-1050.

Also, please note the regulation entitled, "Misbranding by reference to premarket notification" (21 CFR 807.97). For questions regarding the reporting of adverse events under the MDR regulation (21 CFR Part 803), please go to https://www.fda.gov/medical-devices/medical-device-safety/medical-device-reporting-mdr-how-report-medical-device-problems.

For comprehensive regulatory information about medical devices and radiation-emitting products, including information about labeling regulations, please see Device Advice (https://www.fda.gov/medical-devices/device-advice-comprehensive-regulatory-assistance) and CDRH Learn (https://www.fda.gov/training-and-continuing-education/cdrh-learn). Additionally, you may contact the Division of Industry and Consumer Education (DICE) to ask a question about a specific regulatory topic. See the DICE website (https://www.fda.gov/medical-devices/device-advice-comprehensive-regulatory-assistance/contact-us-division-industry-and-consumer-education-dice) for more information or contact DICE by email (DICE@fda.hhs.gov) or phone (1-800-638-2041 or 301-796-7100).

Sincerely,

Paula V. Caposino -S

Paula Caposino
Acting Deputy Director
Division of Chemistry
and Toxicology Devices
OHT7: Office of In Vitro Diagnostics
Office of Product Evaluation and Quality
Center for Devices and Radiological HealthEnclosure

Enclosure

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Food and Drug Administration

# Indications for Use

Form Approved: OMB No. 0910-0120
Expiration Date: 07/31/2026
*See PRA Statement below.*

Submission Number *(if known)*

K230300

Device Name

i-STAT CG8+ cartridge with the i-STAT 1 System

Indications for Use *(Describe)*

The i-STAT CG8+ cartridge with the i-STAT 1 System is intended for use in the in vitro quantification of ionized calcium and hematocrit in arterial or venous whole blood in point of care or clinical laboratory settings.

The i-STAT CG8+ cartridge with the i-STAT 1 System is intended for use in the in vitro quantification of hematocrit in capillary whole blood in point of care or clinical laboratory settings.

Ionized calcium measurements are used in the diagnosis, monitoring, and treatment of conditions including, but not limited to, parathyroid disease, a variety of bone diseases, chronic renal disease, tetany, and disturbances related to surgical and intensive care.

Hematocrit measurements can aid in the determination and monitoring of normal or abnormal total red cell volume status that can be associated with conditions including anemia, erythrocytosis, and blood loss related to trauma and surgery.

Type of Use *(Select one or both, as applicable)*

☒ Prescription Use (Part 21 CFR 801 Subpart D) ☐ Over-The-Counter Use (21 CFR 801 Subpart C)

**CONTINUE ON A SEPARATE PAGE IF NEEDED.**

Abbott

# 510(k) SUMMARY

The information in this 510(k) summary is being submitted in accordance with the requirements of 21 CFR 807.92.

## I. SUBMITTER INFORMATION

| | |
|---|---|
| Owner | Abbott Point of Care Inc.<br>400 College Road East<br>Princeton, NJ 08540 |
| Contact | Primary: Brian Ma, PhD<br>Principal Specialist Regulatory Affairs<br>Phone: +1 613-688-5949<br><br>Secondary: Mojgan Soleimani<br>Associate Director Regulatory Affairs<br>Phone: +1 613-295-0932 |
| Date Prepared | October 27, 2023 |

## II. DEVICE INFORMATION

| | |
|---|---|
| Proprietary Name | *i-STAT CG8+* cartridge with the *i-STAT 1 System* |
| Common Name | Chemistry test, hematology test, analyzer, handheld |
| 510(k) Number | K230300 |

| Product Code | Device Classification Name | Regulation Number | Class | Panel |
|---|---|---|---|---|
| JFP | Electrode, Ion Specific, Calcium | 862.1145 | II | Clinical Chemistry |
| JPI | Device, Hematocrit, Measuring | 864.6400 | II | Hematology |

## III. PREDICATE DEVICE

| | |
|---|---|
| Proprietary Name | *i-STAT CHEM8+* cartridge with the *i-STAT 1 System* |
| 510(k) Number | K191360 |

| Product Code | Device Classification Name | Regulation Number | Class | Panel |
|---|---|---|---|---|
| JFP | Electrode, Ion Specific, Calcium | 862.1145 | II | Clinical Chemistry |

## IV. DEVICE DESCRIPTION

The *i-STAT CG8+* cartridge is used with the *i-STAT 1* analyzer as part of the *i-STAT 1 System* and contains test reagents to measure hematocrit (Hct) in arterial, venous or capillary whole blood and to measure ionized calcium (iCa) in arterial and venous whole blood.

The *i-STAT 1 System* is an *in vitro* diagnostic (IVD) medical device intended for the quantitative determination of various clinical chemistry tests contained within i-STAT cartridges using whole blood. The *i-STAT 1 System* consists of a portable blood analyzer (*i-STAT 1* analyzer), single-use disposable test cartridges (i-STAT cartridges), liquid quality control and calibration verification materials, and accessories (*i-STAT 1 Downloader/Recharger*, *i-STAT Electronic Simulator* and *i-STAT 1 Printer*). The *i-STAT 1 System*, including the *i-STAT CG8+* cartridge, is designed for use by trained medical professionals in point of care or clinical laboratory settings and is for prescription use only.

The *i-STAT CG8+* cartridge contains the required sensors, a fluid pack (calibrant pouch), a sample entry well and closure, fluid channels, waste chamber, and the necessary mechanical features for controlled fluid movement within cartridge. The i-STAT cartridge format allows all the tests in the cartridge to be performed simultaneously. All the test steps and fluid movement occur within the *i-STAT CG8+* cartridge. Cartridges require two to three drops of whole blood which are applied to the cartridge using a transfer device by the trained user before the cartridge is placed within the analyzer.

The *i-STAT 1* analyzer is a handheld, *in vitro* diagnostic analytical device designed to run only *i-STAT* test cartridges. The instrument interacts with the *i-STAT CG8+* cartridge to move fluid across the sensors and generate a quantitative result (within approximately 2 minutes).

## V. INTENDED USE STATEMENT

The *i-STAT CG8+* cartridge with the *i-STAT 1 System* is intended for use in the *in vitro* quantification of ionized calcium and hematocrit in arterial or venous whole blood in point of care or clinical laboratory settings.

The i-STAT CG8+ cartridge with the *i-STAT 1 System* is intended for use in the *in vitro* quantification of hematocrit in capillary whole blood in point of care or clinical laboratory settings.

Ionized calcium measurements are used in the diagnosis, monitoring, and treatment of conditions including, but not limited to, parathyroid disease, a variety of bone diseases, chronic renal disease, tetany, and disturbances related to surgical and intensive care.

Hematocrit measurements can aid in the determination and monitoring of normal or abnormal total red cell volume status that can be associated with conditions including anemia, erythrocytosis, and blood loss related to trauma and surgery.

## VI. SUMMARY COMPARISON OF TECHNOLOGICAL CHARACTERISTICS

| Table 1: Similarities and Differences (Test and Instrument): iCa and Hct in Whole Blood | | |
|---|---|---|
| **Feature or Characteristic** | **Candidate Devices:**<br>iCa and Hct Tests in the:<br>*i-STAT CG8+* cartridge<br>with the *i-STAT 1 System* | **Predicate Device:**<br>iCa Test in the:<br>*i-STAT CHEM8+* cartridge<br>with the *i-STAT 1 System*<br>(K191360) |
| **Intended Use** | The *i-STAT CG8+* cartridge with the *i-STAT 1 System* is intended for use in the *in vitro* quantification of ionized calcium and hematocrit in arterial or venous whole blood in point of care or clinical laboratory settings.<br><br>The *i-STAT CG8+* cartridge with the *i-STAT 1 System* is intended for use in the *in vitro* quantification of hematocrit in capillary whole blood in point of care or clinical laboratory settings.<br><br>Ionized calcium measurements are used in the diagnosis, monitoring, and treatment of conditions including, but not limited to, parathyroid disease, a variety of bone diseases, chronic renal disease, tetany, and disturbances related to surgical and intensive care.<br><br>Hematocrit measurements can aid in the determination and monitoring of normal or abnormal total red cell volume status that can be associated with conditions including anemia, erythrocytosis, and blood loss related to trauma and surgery. | The i-*STAT CHEM8+* cartridge with the *i-STAT 1 System* is intended for use in the in vitro quantification of ionized calcium in arterial or venous whole blood in point of care or clinical laboratory settings.<br><br>Ionized calcium measurements are used in the diagnosis and treatment of parathyroid disease, a variety of bone diseases, chronic renal disease and tetany. |
| **Device Classification** | Same | Class II |
| **Product Code** | JFP (iCa)<br>JPI (Hct) | JFP (iCa) |
| **Regulation No.** | 862.1145 (iCa)<br>864.6400 (Hct) | 862.1145 (iCa) |
| **Reportable Range** | Same | iCa: 0.25 – 2.50 mmol/L; 1.0 – 10.0 mg/dL<br>Hct: 15 – 75 %PCV; 0.15 – 0.75 Fraction |

<table>
<tr><th colspan="3">Table 1: Similarities and Differences (Test and Instrument): iCa and Hct in Whole Blood</th></tr>
<tr><th>Feature or Characteristic</th><th>Candidate Devices:<br>iCa and Hct Tests in the:<br>i-STAT CG8+ cartridge<br>with the i-STAT 1 System</th><th>Predicate Device:<br>iCa Test in the:<br>i-STAT CHEM8+ cartridge<br>with the i-STAT 1 System<br>(K191360)</th></tr>
<tr><td>Sample Type</td><td><table><tr><td>iCa</td><td>Arterial or venous whole blood</td></tr><tr><td>Hct</td><td>Arterial, venous, or capillary whole blood</td></tr></table></td><td>Arterial and venous whole blood</td></tr>
<tr><td>Sample Volume</td><td>Same</td><td>95 µL</td></tr>
<tr><td>Sample Preparation</td><td>Same</td><td>Ready to Use</td></tr>
<tr><td>Sample collection</td><td><table><tr><th></th><th>iCa</th><th>Hct</th></tr><tr><td>Without anticoagulant</td><td colspan="2">Arterial or venous</td></tr><tr><td>With balanced heparin anticoagulant or lithium heparin anticoagulant</td><td>Arterial or venous</td><td>Arterial, venous, or capillary</td></tr></table></td><td>With balanced heparin anticoagulant or lithium heparin anticoagulant</td></tr>
<tr><td>Traceability</td><td>Same</td><td><table><tr><td>iCa</td><td>NIST SRM956</td></tr><tr><td>Hct</td><td>CLSI H07-A3 procedure for determining packed cell volume by the microhematocrit method</td></tr></table></td></tr>
<tr><td>Calibration</td><td>Same</td><td>1-point on-board contained within cartridge</td></tr>
<tr><td>Principle of Measurement</td><td>iCa: Ion-selective electrode potentiometry<br>Hct: Conductometric method</td><td>iCa: Ion-selective electrode potentiometry</td></tr>
<tr><td>Reagent Format</td><td>Same</td><td>Cartridge</td></tr>
<tr><td>Reagent Storage and Stability</td><td>Refrigerated at 2-8°C (35-46°F) until expiration date<br>Room Temperature at 18-30°C (64-86°F) for 2 months</td><td>Refrigerated at 2-8°C (35-46°F) until expiration date<br>Room Temperature at 18-30°C (64-86°F) for 14 days</td></tr>
<tr><td>Analyzer Type</td><td>Same</td><td>Handheld</td></tr>
</table>

## VII. PERFORMANCE CHARACTERISTICS

### *A. Analytical Performance*

#### a. Precision/Reproducibility:

*i. Precision 20 days (Aqueous materials)*

The precision of the i-STAT Ionized Calcium (iCa) test in the *i-STAT CG8+* cartridge on the *i-STAT 1 System* was evaluated using five (5) levels of aqueous material. The precision of the i-STAT Hematocrit (Hct) test in the *i-STAT CG8+* cartridge on the *i-STAT 1 System* was evaluated using four (4) levels of aqueous materials. This 20-day precision testing was based on CLSI document EP05-A3: *Evaluation of Precision of Quantitative Measurement Procedures; Approved Guideline – Third Edition*. Each study was conducted using multiple analyzers and one (1) test cartridge lot over at least 20 days at one site. Repeatability, between-run, between-day, and within-laboratory precision were estimated for each level. The results of the 20-day precision study for the *i-STAT CG8+* cartridge on the *i-STAT 1 System* are shown in **Table 2**.

**Table 2: Results of 20-Day Precision of the i-STAT CG8+ Cartridge on the i-STAT 1 Analyzer**

| Test (units) | Fluid Level | N | Mean | Repeatability | | Between-run | | Between-day | | Within-Laboratory | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | SD | %CV | SD | %CV | SD | %CV | SD | %CV |
| iCa (mmol/L) | CV L1 | 80 | 2.280 | 0.0129 | 0.57 | 0.0050 | 0.22 | 0.0036 | 0.16 | 0.0144 | 0.63 |
| | CV L2 | 80 | 1.517 | 0.0073 | 0.48 | 0.0023 | 0.15 | 0.0020 | 0.13 | 0.0080 | 0.52 |
| | CV L3 | 80 | 1.282 | 0.0080 | 0.63 | 0.0020 | 0.15 | 0.0018 | 0.14 | 0.0085 | 0.66 |
| | CV L4 | 80 | 0.763 | 0.0034 | 0.44 | 0.0018 | 0.23 | 0.0010 | 0.13 | 0.0039 | 0.51 |
| | CV L5 | 80 | 0.260 | 0.0018 | 0.68 | 0.0007 | 0.27 | 0.0006 | 0.22 | 0.0020 | 0.76 |
| Hct (%PCV) | CV L2 | 81 | 22.0 | 0.38 | 1.74 | 0.12 | 0.54 | 0.11 | 0.48 | 0.42 | 1.89 |
| | CV L3 | 80 | 35.0 | 0.41 | 1.17 | 0.14 | 0.40 | 0.11 | 0.32 | 0.45 | 1.27 |
| | CV L4 | 80 | 56.4 | 0.22 | 0.40 | 0.12 | 0.21 | 0.10 | 0.18 | 0.27 | 0.48 |
| | CV L5 | 82 | 66.3 | 0.24 | 0.35 | 0.02 | 0.03 | 0.06 | 0.09 | 0.24 | 0.37 |

*ii. Multi-site and operator-to-operator precision (Aqueous materials)*

Multi-day precision testing was performed at three (3) sites using a panel of aqueous solutions containing five (5) levels of ionized calcium and a second panel of aqueous solutions containing five (5) levels of hematocrit. At each site, each level was tested once a day by two (2) operators for five (5) days on six (6) *i-STAT 1* Analyzers using *i-STAT CG8+* cartridges. Within-run, between-day, between-operator and within-site (total) variance components were calculated by site. These components were also calculated for all sites combined and provided in the **Table 3** below.

| Table 3: Multi-Day Precision of the i-STAT CG8+ Cartridge on the i-STAT 1 Analyzer | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Test (units) | Fluid Level | N | Mean | Within-Run | | Between-Day | | Between-Operator | | Within-Site (Total) | | Between-Site | | Overall | |
| | | | | SD | %CV | SD | %CV | SD | %CV | SD | %CV | SD | %CV | SD | %CV |
| iCa (mmol/L) | CV L1 | 91 | 2.323 | 0.0147 | 0.63 | 0.0104 | 0.45 | 0.0000 | 0.00 | 0.018 | 0.77 | 0.0079 | 0.34 | 0.0196 | 0.84 |
| | CV L2 | 90 | 1.535 | 0.0078 | 0.51 | 0.0043 | 0.28 | 0.0000 | 0.00 | 0.0089 | 0.58 | 0.0018 | 0.12 | 0.0091 | 0.59 |
| | CV L3 | 97 | 1.288 | 0.0068 | 0.53 | 0.0000 | 0.00 | 0.0013 | 0.10 | 0.0069 | 0.53 | 0.0000 | 0.00 | 0.0069 | 0.53 |
| | CV L4 | 90 | 0.762 | 0.0049 | 0.64 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0049 | 0.64 | 0.0008 | 0.10 | 0.0049 | 0.65 |
| | CV L5 | 90 | 0.260 | 0.0011 | 0.41 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0011 | 0.41 | 0.0000 | 0.00 | 0.0011 | 0.41 |
| Hct (%PCV) | CV L1 | 90 | 12.2 | 0.34 | 2.75 | 0.18 | 1.45 | 0.11 | 0.89 | 0.39 | 3.24 | 0.12 | 0.97 | 0.41 | 3.38 |
| | CV L2 | 90 | 22.1 | 0.35 | 1.57 | 0.00 | 0.00 | 0.13 | 0.57 | 0.37 | 1.67 | 0.20 | 0.92 | 0.42 | 1.90 |
| | CV L3 | 90 | 35.1 | 0.36 | 1.03 | 0.00 | 0.00 | 0.08 | 0.22 | 0.37 | 1.06 | 0.11 | 0.31 | 0.39 | 1.10 |
| | CV L4 | 90 | 56.3 | 0.45 | 0.80 | 0.09 | 0.16 | 0.00 | 0.00 | 0.46 | 0.81 | 0.27 | 0.48 | 0.53 | 0.95 |
| | CV L5 | 90 | 66.1 | 0.31 | 0.47 | 0.17 | 0.26 | 0.06 | 0.10 | 0.36 | 0.54 | 0.14 | 0.21 | 0.38 | 0.58 |

*iii. Precision (Whole Blood)*

Whole blood precision of the i-STAT Ionized Calcium and Hematocrit tests in the *i-STAT CG8+* cartridge on the *i-STAT 1* System was evaluated using whole blood specimens [1] collected with lithium heparin. The whole blood precision was assessed using the duplicate test results collected across multiple point of care sites. The mean values for each sample were divided into subintervals for each sample type across the reportable range for each i-STAT test. The results are summarized in **Table 4**.

**Table 4: Whole Blood Precision of arterial, venous, and capillary whole blood for i-STAT CG8+ cartridge on the i-STAT 1 Analyzer**

| Test (units) | Sample Type | Sample Range | N | Mean | SD | %CV |
|---|---|---|---|---|---|---|
| iCa (mmol/L) | Venous Whole Blood | 0.25-0.75 | 5 | 0.468 | 0.0045 | 0.96 |
| | | >0.75-1.20 | 95 | 1.123 | 0.0094 | 0.84 |
| | | >1.20-1.50 | 77 | 1.281 | 0.0165 | 1.29 |
| | | >1.50-2.50 | 7 | 2.179 | 0.0214 | 0.98 |
| | Arterial Whole Blood | 0.25-0.75 | 0 | N/A | N/A | N/A |
| | | >0.75-1.20 | 92 | 1.144 | 0.0063 | 0.55 |
| | | >1.20-1.50 | 58 | 1.282 | 0.0114 | 0.89 |
| | | >1.50-2.50 | 3 | 1.797 | 0.0100 | 0.56 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| Hct (%PCV) | Venous Whole Blood | 15-35 | 88 | 27.3 | 0.45 | 1.63 |
| | | >35-50 | 75 | 39.4 | 2.20 | 5.59 |
| | | >50-75 | 7 | 60.1 | 0.46 | 0.77 |
| | Arterial Whole Blood | 15-35 | 104 | 26.3 | 0.55 | 2.08 |
| | | >35-50 | 45 | 38.9 | 0.48 | 1.24 |
| | | >50-75 | 2 | 50.0 | 0.00 | 0.00 |
| | Capillary Whole Blood | 15-35 | 28 | 29.5 | 1.23 | 4.18 |
| | | >35-50 | 109 | 41.1 | 1.10 | 2.68 |
| | | >50-75 | 17 | 53.5 | 0.95 | 1.78 |

## b. Linearity/assay reportable range:

*i. Linearity*

The study was designed based on CLSI EP06-Ed2: *Evaluation of the Linearity of Quantitative Measurement Procedures – Second Edition.*

The linearity of the i-STAT Ionized Calcium and Hematocrit tests in the *i-STAT CG8+* cartridge with the *i-STAT 1 System* was evaluated by preparing whole blood samples of varying analyte levels for each *i-STAT* test. The i-STAT Ionized Calcium and Hematocrit tests in the *i-STAT CG8+ cartridge* demonstrated linearity over the reportable range for each *i-STAT* test. Regression summary of the response for each *i-STAT* test versus the concentration of the whole blood samples of varying analyte levels is provided in **Table 5**.

**Table 5: Regression Summary for the i-STAT iCa and Hct tests in the i-STAT CG8+ Cartridge on the i-STAT 1 Analyzer**

| Test | Units | Reportable Range | Range Tested | Slope | Intercept | $R^2$ |
|---|---|---|---|---|---|---|
| iCa | mmol/L | 0.25 – 2.50 | 0.204 – 2.832 | 1.016 | 0.019 | 0.9981 |

[1] The capillary whole blood clinical precision study design included the performance of two individual fingersticks, collected independently by two operators into two separate capillary tubes and tested on two (2) i-STAT CG8+ cartridges.

| Table 5: Regression Summary for the i-STAT iCa and Hct tests in the i-STAT CG8+ Cartridge on the i-STAT 1 Analyzer | | | | | | |
|---|---|---|---|---|---|---|
| **Test** | **Units** | **Reportable Range** | **Range Tested** | **Slope** | **Intercept** | **$R^2$** |
| Hct | %PCV | 15 – 75 | 12.7 – 78.3 | 1.031 | -0.592 | 0.9992 |

### c. Detection Limit

*i. Limit of Quantitation (LoQ)*

The study was based on the CLSI EP17-A2: *Evaluation of Detection Capability for Clinical Laboratory Measurement Procedures; Approved Guideline – Second Edition.*

The LoQ of the i-STAT Ionized Calcium and Hematocrit tests in the *i-STAT CG8+* cartridge was evaluated on the *i-STAT 1* analyzer using two (2) *i-STAT CG8+* cartridge lots, and whole blood that was altered to a low analyte level for each i-STAT test. The LoQ for the *i-STAT* Ionized Calcium and Hematocrit tests in the *i-STAT CG8+* cartridge was determined to be at or below the lower limit of the reportable range for each of the *i-STAT* tests as shown in **Table 6**.

| Table 6: Summary of LoQ Results for i-STAT Tests in the i-STAT CG8+ Cartridge | | |
|---|---|---|
| **Test (units)** | **Lower limit of the reportable range** | **Determined LoQ** |
| iCa (mmol/L) | 0.25 | 0.15 |
| Hct (%PCV) | 15 | 13 |

*ii. Limit of Blank and Detection (LoB/LoD)*

The study was based on CLSI EP17-A2: *Evaluation of Detection Capability for Clinical Laboratory Measurement Procedures; Approved Guideline – Second Edition.*

The LoB and LoD of the i-STAT Ionized Calcium (iCa) and Hematocrit (Hct) tests in the *i-STAT CG8+* cartridge were evaluated on the *i-STAT 1* analyzer using two (2) *i-STAT CG8+* cartridge lots for each test. Whole blood was altered to blank ionized calcium and hematocrit levels for LoB testing. Whole blood was altered to two (2) low levels of ionized calcium and four (4) low levels of hematocrit for LoD testing.

The LoB and LoD were determined based on the maximal LoB or LoD value obtained for each lot tested.

The determined LoB and LoD for i-STAT Ionized Calcium and Hematocrit tests in the *i-STAT CG8+* cartridge on the *i-STAT 1* analyzer are shown in the **Table 7**.

| Table 7: Summary of LoB and LoD Results | | |
|---|---|---|
| **Test (units)** | **i-STAT CG8+ Cartridge** | |
| | **LoB** | **LoD** |
| iCa (mmol/L) | 0.119 | 0.125 |
| Hct (%PCV) | 0 | 0.4 |

### d. Analytical Specificity

*i. Interference*

The study was based on CLSI EP07-ED3: *Interference Testing in Clinical Chemistry, Third Edition.*

The interference performance of the i-STAT Ionized Calcium and Hematocrit tests in the *i-STAT CG8+* cartridge on the *i-STAT 1* analyzer with the *i-STAT 1 System*

was evaluated using whole blood samples based on CLSI EP07-ED3: *Interference Testing in Clinical Chemistry, Third Edition*. The effect of each substance was evaluated by comparing the performance of a control sample, spiked with blank solvent solution, with the test results from a test sample spiked with the potentially interfering substance at the toxic/pathological concentration based on CLSI EP37-ED1: *Supplemental Tables for Interference Testing in Clinical Chemistry, First Edition*, as applicable. A substance was identified as an interferent if the difference between the control and test samples was outside of the allowable error (±Ea) for the i-STAT test. For an identified interferent, a dose-response was performed to determine the degree of interference as a function of the substance concentration.

**Table 8** contains the list of potentially interfering substances tested and the interference results for the *i-STAT CG8+* cartridge.

**Table 8: Potentially Interfering Substances and Test Concentrations for the i-STAT tests in the i-STAT CG8+ Cartridge**

| Substance [2] | Test Concentration | | i-STAT Test | Interference (Yes/No) | Comments |
|---|---|---|---|---|---|
| | mmol/L (unless specified) | mg/dL (unless specified) | | | |
| Acetaminophen | 1.03 | 15.6 | iCa | No | |
| Acetyl Cysteine (N-Acetyl-L-Cysteine) | 0.92 | 15 | iCa | No | |
| Ascorbic Acid (L-Ascorbic Acid) | 0.298 | 5.25 | iCa | No | |
| β-Hydroxybutyric Acid[3] | 6.0 | 62.46 | iCa | No | |
| Bilirubin | 0.684 | 40 | iCa | No | |
| | | | Hct | No | |
| Bromide [3] (Lithium Bromide) | 2.5 | 21.7 | iCa | No | |
| | | | Hct | No | |
| | 37.5 | 325.7 | iCa | Yes | Use Another Method |
| | | | Hct | Yes | |
| Cholesterol | 11.0 | 425 | iCa | No | |
| Hemoglobin | 10 g/L | 1000 | iCa | No | |
| Intralipid 20% | N/A | 3447 | iCa | No | |
| | | 2325 | Hct | No | |
| Iodide (Sodium Iodide)[3] | 2.99 | 44.82 | iCa | No | |
| Lactate (Lithium Lactate) | 10 | 90 | iCa | Yes | Decreased results ≥ 6 mmol/L |
| Leflunomide | 0.722 | 19.5 | iCa | Yes | Decreased results ≥ 0.345 mmol/L |
| Magnesium (Magnesium Chloride) | 4.1 | 10 | iCa | Yes | Increased results ≥ 3.5 mmol/L |
| Nithiodote (Sodium Thiosulfate)[3] | 16.7 | 264.04 | Hct | No | |
| | | | iCa | Yes | Decreased results ≥ 5.3 mmol/L |
| Potassium (Potassium Chloride) | 8 | 59.6 | iCa | No | |
| Salicylate (Lithium Salicylate) | 0.207 | 2.86 | iCa | No | |
| Sodium (Sodium Chloride) | 170 | 993.48 | iCa | No | |

[2] The test concentration for this substance is not included in CLSI guideline EP37 1st edition.
~~2~~[3] The compound tested to evaluate the interfering substance is presented in parenthesis.

| Table 8: Potentially Interfering Substances and Test Concentrations for the i-STAT tests in the i-STAT CG8+ Cartridge | | | | | |
|---|---|---|---|---|---|
| Substance [2] | Test Concentration | | i-STAT Test | Interference (Yes/No) | Comments |
| | mmol/L (unless specified) | mg/dL (unless specified) | | | |
| Teriflunomide [3] | 0.722 | 19.5 | iCa | Yes | Decreased results ≥ 0.049 mmol/L |
| Thiocyanate (Lithium Thiocyanate) | 0.898 | 5.22 | iCa | Yes | Decreased results ≥ 0.898 mmol/L |
| Total Protein (Human Serum Albumin) | 15 g/dL | 150 g/L | Hct | Yes | Increased results ≥ 9.5 g/dL |
| Triglyceride | 16.94 | 1500 | iCa | No | |
| | | | Hct | No | |
| White Blood Cells | 50,000 WBC/µL | N/A | Hct | No | |

## *B. Comparison Studies*

### a. Method Comparison with Comparator Device

Method comparison for the *i-STAT CG8+* cartridge with the *i-STAT 1 System* was demonstrated in studies based on CLSI EP09c-ED3: *Measurement Procedure Comparison and Bias Estimation Using Patient Samples – Third Edition*.

Lithium heparin venous and arterial whole blood specimens collected across multiple point of care sites were evaluated using *i-STAT CG8+* cartridges on the *i-STAT 1* analyzer against whole blood specimens tested on a comparative method. For ionized calcium and hematocrit, the first replicate result from the *i-STAT 1* analyzer was compared to the mean result from the comparative method.

Two (2) capillary whole blood specimens collected from skin puncture with balanced heparin capillary tubes from each study subject across multiple point of care sites were evaluated and analyzed in singlicate on the i-STAT 1 analyzer against the comparative method. A Passing-Bablok linear regression analysis for hematocrit was performed using the singlicate result from the *i-STAT 1* analyzer versus the singlicate result of the comparative method.

The venous and arterial data were pooled, and a Passing-Bablok linear regression analysis was performed using the i-STAT Ionized Calcium results from the *i-STAT CG8+* cartridges on the i-STAT 1 analyzer versus the comparative method results. Method comparison results comparing the i-STAT Ionized Calcium performance on the i-STAT 1 analyzer to comparative method for arterial and venous are shown in **Table 9**. In the table, N is the number of specimens in the data set, and r is the correlation coefficient.

| Table 9: Method Comparison Results for the i-STAT iCa test in the i-STAT CG8+ Cartridge with i-STAT 1 System | | | | | | | |
|---|---|---|---|---|---|---|---|
| Test (units) | Comparative Method | N | Slope | Intercept | r | Medical Decision Level | Bias at Medical Decision Level |
| | Arterial/Venous | | | | | | |
| iCa (mmol/L) | i-STAT CHEM8+ | 343 | 1.02 | -0.02 | 0.99 | 0.37 | -0.009 |
| | | | | | | 0.82 | 0.003 |

The venous, arterial, and capillary whole blood data were pooled, and a Passing-Bablok linear regression analysis was performed using the i-STAT Hematocrit results from the *i-STAT CG8+* cartridges on the *i-STAT 1* analyzer versus the comparative method results.

Method comparison results comparing the i-STAT Hematocrit performance on the i-STAT 1 analyzer to the comparative method for arterial venous, and capillary whole blood specimens are shown in **Table 10**. In the table, N is the number of specimens in the data set, and r is the correlation coefficient.

**Table 10: Method Comparison Results for the i-STAT Hct test in the i-STAT CG8+ Cartridge with i-STAT 1 System**

| Test (units) | Comparative Method | | N | Slope | Intercept | r | Medical Decision Level | Bias at Medical Decision Level |
|---|---|---|---|---|---|---|---|---|
| | Arterial/ Venous | Capillary | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| Hct (%PCV) | i-STAT CHEM8+ | Epoc Blood Analysis System | 535 | 1.000 | -1.00 | 0.98 | 33 | -1.0 |
| | | | | | | | 53 | -1.0 |
| | | | | | | | 56 | -1.0 |
| | | | | | | | 70 | -1.0 |

The method comparison results for capillary whole blood specimens only for the i-STAT Hematocrit test are shown in **Table 11**.

**Table 11: Results for i-STAT CG8+ Cartridge with i-STAT 1 System - Native and Contrived Capillary Specimens**

| Test (units) | N | Slope | Intercept | r | Range |
|---|---|---|---|---|---|
| | | | | | |
| Hct (%PCV) | 208 | 1.000 | 0.00 | 0.97 | 18-73 |

Bias at the medical decision levels for native capillary whole blood specimens only for the i-STAT Hematocrit test are shown in **Table 12**.

**Table 12: Results for i-STAT CG8+ Cartridge with i-STAT 1 System - Native Capillary Specimens Bias at Medical Decision Levels**

| Test (units) | N | Range Min | Range Max | Medical Decision Level | Bias | |
|---|---|---|---|---|---|---|
| | | | | | Estimate | 95% CI |
| | | | | | | |
| | | | | | | |
| Hct (%PCV) | 193 | 23 | 68 | 33 | 0.0 | (-1.0, 0.0) |
| | | | | 53 | 0.0 | (-1.0, 0.0) |
| | | | | 56 | 0.0 | (-1.0, 0.0) |
| | | | | 70 | 0.0 | (-1.0, 0.0) |

## b. Matrix Equivalence

A matrix equivalence study was conducted to evaluate the performance of the *i-STAT* Ionized Calcium and Hematocrit tests in the *i-STAT CG8+* cartridge on the *i-STAT 1* System using non-anticoagulated venous and arterial whole blood specimens. The study design and analysis method were based on recommendations from the Clinical and Laboratory Standards Institute (CLSI) guideline EP35: *Assessment of Equivalence or Suitability of Specimen Types for Medical Laboratory Measurement Procedures, 1st ed*. The matrix equivalence of each test in the *i-STAT CG8+* cartridge was assessed by comparing arterial or venous whole blood specimens collected without

anticoagulant (candidate specimen type) to samples collected with balanced heparin or lithium heparin anticoagulant (primary specimen type). Each specimen was tested in duplicate using two (2) *i-STAT CG8+* cartridges with two (2) *i-STAT 1* analyzers. A Passing-Bablok linear regression analysis was performed using the first replicate result from the candidate (y-axis) versus the mean result from the primary specimen (x-axis). The regression analysis results are summarized in **Table 13**. In the table, N is the number of specimens in the data set, and r is the correlation coefficient.

**Table 13: Matrix Equivalence Results**

| Test (units) | N | Candidate Specimen Range | Primary Specimen Range | r | Slope | Intercept |
|---|---|---|---|---|---|---|
| iCa (mmol/L) | 298 | 0.44-2.43 | 0.45-2.42 | 0.99 | 1.00 | 0.01 |
| Hct (%PCV) | 293 | 15-73 | 15-73 | 0.99 | 1.000 | 0.00 |

## VIII. CONCLUSION

The results of these studies demonstrate that performance of the i-STAT Ionized Calcium and Hematocrit tests in the *i-STAT CG8+* cartridge with the *i-STAT 1 System* are substantially equivalent to the predicate device.