# Organization(s):

North Carolina Baptist Hospital (NCBH)

Lexington Medical Center (LMC)

Davie Medical Center (DMC)

Wilkes Medical Center (WMC)

High Point Medical Center (HPMC)

Wake Forest Health Network (WFHN)

Wake Forest University Health Sciences (WFUHS)

Wake Forest University School of Medicine

NCBH Outpatient Endoscopy

Wake Forest Baptist Imaging, LLC (WFBI)

# Purpose

The purpose of this procedure is to provide guidelines for staff and ensure they are competent to perform i-STAT testing.

General Procedure Statement

1. The Clinical Laboratory at Wake Forest Baptist Medical Center (WFBMC) is responsible for oversight of explicitly identified non-waived laboratory testing. Specific non-waived point of care testing (POCT) sites have been identified and included under the CLIA certificate of the WFBMC Clinical Laboratories for a highly complex lab. Testing policies and procedures must meet all regulatory guidelines established by CLIA and the accreditation standards established by the College of American Pathologists (CAP).
2. Any waived testing sites should perform i-STAT testing according to established protocols and per manufacturer instructions. Each specific user site must have approval from the WFBMC Point of Care Committee to perform testing.
3. Only staff members who have been trained and completed required competency assessment for i-STAT may perform this testing.
4. All testing personnel must read the procedure manual and demonstrate successful i-STAT testing under the direction and supervision of an authorized staff member, once successful demonstration of testing has been performed, it will be documented on the employee’s training checklist.
5. All i-STAT testing should have a documented physician order or be performed following a documented protocol. Staff should not perform testing on themselves, co-workers, or visitors. Results can be traced back to the device, location, and user.

# Scope

Non-Waived POCT sites covered by the Clinical Laboratory CLIA certificate shall adhere to processes outlined in this document. For waived sites, all staff members who are educated and qualified to perform waived testing by their job descriptions are responsible for following this procedure.

# Responsible Department/Party/Parties

1. **Procedure Owner**: Point of Care Testing Compliance Manager
2. **Procedure**: Non-Waived POCT sites covered by the WFBMC Clinical Laboratory CLIA certificate and waived sites shall adhere to processes outlined in this document.
3. **Supervision**: The Medical Director and/or laboratory director. As indicated on covering CLIA certificate for Point of Care Testing, shall supervise the person(s) performing activities outlined in this document.
4. **Implementation**: Each applicable POCT laboratory director and/or site manager is responsible for ensuring compliance with processes stated in this document.

# Definitions

1. ***Procedure***: A process or method for accomplishing a specific task or objective.

1. ***WFBH***: Wake Forest Baptist Health (WFBH) is a health system that includes Wake Forest Baptist Medical Center and all affiliated organizations including Wake Forest University Health Sciences (WFUHS), North Carolina Baptist Hospital (NCBH), Lexington Medical Center (LMC), Davie Medical Center (DMC), Wilkes Medical Center (WMC), High Point Medical Center (HPMC), Wake Forest Baptist Imaging, LLC (WFBI), NCBH Outpatient Endoscopy, Wake Forest Health Network (WFHN), High Point Surgery Center, LLC and Premier Surgery Center.
2. ***Point of Care Testing (POCT)***: Tests designed to be used at or near the site where the patient is located, do not require permanent dedicated space, and are performed outside the physical facilities of the clinical laboratory.
3. ***Non-Waived Tests***: Tests of moderate or high complexity as designated by the FDA.
4. ***Waived Tests***: Tests of low complexity as designated by the FDA; tests that are simple and have low risk for erroneous results.
5. ***Clinical Laboratory Improvement Amendments (CLIA)***: United States federal regulatory standards that apply to all laboratory testing performed on humans.
6. ***College of American Pathologists (CAP)***: Accrediting agency for the WFBH Clinical Laboratory. Point of Care sites included on the CLIA certificate of the Clinical Laboratory ae accountable to standards set forth by CAP.
7. ***The Joint Commission (TJC)***: Accrediting agency whose standards pertaining to laboratory testing apply to some locations within the WFBH network.
8. ***Quality Control (QC)***: Processes to ensure the test system is performing as expected.
9. ***External QC***: External liquid material or substance with known value(s) for the test(s) being performed.
10. ***Internal QC***: An internal check within the test system to validate the test system is working properly.
11. ***Quality Assurance (QA)***: A system for ensuring a desired level of quality. The POCT program incorporates activities to monitor the quality of processes and the test system.
12. ***Quality Improvement (QI)***: Activities implemented to improve the quality of processes.
13. ***Proficiency Testing (PT)***: Unknown samples sent to a lab/test site by a Centers for Medicare and Medicaid Services (CMS) approved proficiency testing program.
14. ***Technical Limits/ Reportable Range***: The range at which the analyzer has been verified to obtain accurate results. Each analyte has a specific reportable range.
15. ***Normal (Reference) Range***: The range of values for the average patient population.
16. ***Upload/Download/Docking of Device/Analyzer***: Refers to the action of connecting the test devices to the WFBH network to allow transmit of patient results and QC results to the device data manager.
17. ***ADT (Admit/Discharge/Transfer)***: Refers to the visit-specific demographics for a patient.
18. ***CSN (Contact Serial Number)***: Refers to the Electronic Health Record encounter—related to the account number.
19. ***AC***: Part of the CSN that is stored in Wake One; included in the linear barcode on the patient armband (AC is NOT included in the document label CSN barcode).
20. ***Electronic Health Record (EHR)***: Digital version of a patient’s paper medical chart (currently, reference as Wake One).
21. ***Erroneous***: Containing an error, mistaken, incorrect, or wrong.
22. ***Analyzer/Device***: Refers to the handheld test device.

# Procedure Guidelines

1. The i-STAT System is a non-waived (waived for some cartridges/circumstances) testing device that performs critical care blood analysis at the point of care. At WFBH, the i-STAT test system is used by non-laboratory personnel to provide critical lab service at or near the patient. Results are electronically posted to the patient’s electronic health record. This document serves to define the procedures and guidelines for point of care testing using the i-STAT system. The i-STAT System Manual should also be used as a resource for information not specifically covered in this document, such as use of the i-STAT test system and information about specific i-STAT tests (test principles, clinical significance, and interpretation of results).
2. Operator ID Usage Information

Upon satisfactory completion of training for the i-STAT system, each user will be given a user identification number/code. This code is to be entered each time that the i-STAT system is used and is the equivalent of an electronic signature. Each code is assigned exclusively for each testing staff member (operator). It should not be shared with anyone else, as this would be the equivalent of signing another person’s name to work they did not do. The ID codes are considered personal and confidential. Operator ID’s should not be posted for general access of staff members. This code allows tracing of testing personnel. Sharing ID codes or using someone else’s code is prohibited.

1. Safety Precautions/ Safety Equipment
2. Safety Equipment
3. Gloves
4. Gloves should be worn while collecting or analyzing any patient sample.
5. Gloves should be worn while performing any function on the i-STAT, including cleaning, disinfecting, performing quality control (QC), carrying, handling, and downloading they analyzer.
6. Safety Shield (Face or Stand Alone Shield) should be available in each test site.
7. WFBH-approved safety re-sheathable needles
8. Appropriate waste containers should be available for disposal of used cartridges or other blood/sample contaminated non-sharp equipment. Follow appropriate WFBH policies and procedures.
9. Germicidal wipes, fresh 10% bleach, or WFBH-approved disinfectant should be used to decontaminate analyzer between each patient use.
10. Sterile Environment
11. When the i-STAT system is used in a sterile environment such as an OR suite, the analyzer and all supporting equipment should be disinfected prior to and after use in the OR suite/sterile area.
12. The i-STAT analyzer and related equipment should never come in contact with a patient.
13. The analyzer must be disinfected between each patient use.
14. Safety Notes
    * + 1. When opening liquid QC vials, protect fingers by wrapping gauze or tissue around the vial, prior to breaking open.
        2. CAUTION: When using the SCAN function on the i-STAT analyzer, be aware of Laser Radiation—do not stare into beam (Class 2 product- Laser Diode 650nm Maximum Output 1.0mW).
        3. Follow appropriate WFBH battery disposal policies.
        4. If filling the cartridge on a counter top and the counter gets contaminated during sample analysis, decontaminate the counter with a WFBH-approved disinfectant.
        5. If the i-STAT analyzer becomes contaminated at the cartridge insert site, it should be labeled as biohazard and removed from use. Return the unit to the clinical laboratory POCT office.
        6. The i-STAT analyzer must be disinfected with WFBH-approved disinfectant between each patient use.
        7. Follow WFBH policies and procedures for cleaning, disinfection, and discarding of supplies.
        8. Treat all blood sample, proficiency test materials, and quality control materials as a biohazard. Use Standard Precautions!
        9. All sharps should be discarded in WFBH-approved biohazard sharps containers.
15. Equipment - The i-STAT consists of the following primary components:
16. i-STAT analyzer

Analyzers are the handheld i-STAT Portable Clinical Analyzers. WFBH utilizes the i-STAT 1 (300 series). When a sample-filled cartridge is inserted into an analyzer for analysis, the analyzer automatically controls all functions of the testing cycle, including fluid movement within the cartridge, calibration, and continuous quality monitoring. All analyzers that pass the Electronic Simulator test are considered equivalent.

1. Battery Change/Charge

i-STAT 1 analyzers can operate using (2) 9-volt lithium batteries or a rechargeable battery. Refer to the i-STAT System Manual for additional instructions. When performing testing, confirm adequate battery voltage prior to testing (a flashing battery icon or low battery message will indicate low battery voltage). If battery voltage is low, testing may cease in the middle of a patient test.

Note: Alkaline batteries should not be used in the i-STAT analyzers. Use only 9V lithium batteries or i-STAT 1 specific rechargeable batteries.

1. Extreme Temperature Usage

When using the i-STAT analyzer in an area with extreme temperatures. It may be required to insulate the analyzer between testing samples to keep the analyzer’s internal temperature stable. If the analyzer gets too hot or too cold, an error code will occur. Storing the analyzer in an insulated cooler may resolve temperature error codes.

1. i-STAT Data Management System, used to monitor patient results and quality control data.
2. Supplies & Storage Requirements
3. i-STAT Test Cartridges/Inventory

A single use disposable cartridge contains micro-fabricated sensors, a calibrant solution, fluidics system, and a waste chamber. Sensors for a variety of tests are available. Refer to the i-STAT System Manual for details.

1. Storage: The main inventory of cartridges will be stored in each department.
2. Cartridges should be stored at 2º to 8º C (35º to 46ºF) and are good through the package expiration date.
3. Do not allow cartridges to freeze. Cartridges should NOT be stored next to the refrigerator wall as freezing could occur.
4. Follow manufacturer labeling for room temperature storage and expiration dating (18º to 30ºC or 64º to 86ºF).

* Color change temperature indicators will be used to monitor upper level temperature to ensure the environment does not exceed 86ºF.
* In environments where low temperatures are of concern, a minimum/maximum temperature monitoring system will be used to monitor room temperature.

1. Cartridges should not be returned to the refrigerator once they have been at room temperature, and should not be exposed to temperatures above 30ºC (86ºF).
2. Each cartridge should be marked to indicate the appropriate cartridge-specific room-temperature expiration date. The staff member that removes cartridges from the refrigerator is responsible for marking the room temperature expiration date.
3. Cartridges should remain in sealed pouches until time of use.
4. Do not use after the labeled expiration date or erroneous results may be given.
5. Cartridges should be allowed to sit at room temperature without any quick heating. Example: Do not hold close to the body or put on a warm object for quick heating. Follow manufacturer instructions.
6. Storage: Testing site inventory will be obtained by testing site personnel.

The cartridges in the testing sites should be stored at room temperature and kept away from extreme heat or cold.

Do not store on computer, above lights or any other warm surface.

If cartridges are noted as having been exposed to an unacceptable temperature, the cartridges should be removed from patient use and the POCT Coordinator should be notified for further action.

If a user site stores refrigerated cartridges, the refrigerator temperature must be monitored at least daily, 7 days per week, and be maintained at 2º to 8ºC.

Refrigerator temperature logs and ambient temperature/humidity logs are reviewed by the Point of Care Testing office each month.

1. Blood Collection & Transfer Equipment
2. Capillary Testing
3. Warming pad, if applicable
4. Alcohol pad
5. Skin puncture lancet—only auto-disabling, single-use capillary devices will be used for collection of capillary samples.
6. Capillary tubes and caps. NOTE: If ionized calcium is to be tested, a balanced heparin capillary tube should be used.
7. Gauze
8. Bandage
9. Venipuncture Testing for Venous Specimens
10. Venipuncture collection equipment (Refer to the WFBH Intranet—Go to: Department of Pathology (Internal)-Online Resources-Laboratory-Phlebotomy-General Phlebotomy Procedures).
11. Use appropriate collection tube or plain syringe, as indicated in the test specific information listed in the i-STAT System Manual.
12. NOTE: If ionized calcium is to be tested, a balanced heparin blood collection tube should be used or appropriate tube, as references in the i-STAT System Manual.
13. Arterial Testing
14. Plastic syringe with no anticoagulant or a WFBH-approved pre-heparinized blood gas syringe/blood gas collection kit.
15. Cap for syringe
16. Refer to site-specific blood gas collection policies/procedures for specific details.
17. NOTE: If ionized calcium is to be tested, a balanced heparin syringe should be used.
18. Blood Specimens
19. Required Blood Volume

* 17-95 µL depending on cartridge type (See i-STAT System Manual for specific details)

1. Suitable Specimens:
2. Only fresh whole blood may be used for i-STAT testing.
3. Different i-STAT tests require different sample collection techniques and collection devices. Refer to the i-STAT System Manual (Test specific ‘Cartridge and Test Information Sheet’) for specific details not included in this document.
4. Certain samples may be collected in a capillary tube or a plastic syringe without anticoagulant.
5. Test within 3 minutes of collection
6. Certain samples may be collected in a lithium heparinized capillary tube, plastic blood gas syringe, or blood collection tube. Refer to the i-STAT System Manual for specific details regarding timing of testing specimens.

* Capillary samples should be tested within 3 minutes, regardless of sample heparinization.

1. Lactate and ACT samples should be tested immediately after collection with no delay.

* There are additional considerations when testing lactate, ACT test cartridges. Refer to the i-STAT System Manual test specific cartridge and ‘Test Information Sheet’ for additional details.

1. Refer to the i-STAT System Manual for a listing of test-specific acceptable anticoagulants for use with the i-STAT.
2. Sample collection containers must be filled to capacity.
3. Patient Preparation

* There are no specific patient preparation procedures, prior to collecting samples for i-STAT testing. However, if samples are collected from an artery, appropriate testing for collateral circulation (Allen’s testing) should be performed, prior to arterial puncture. Follow site-specific procedures.

1. Specimen Collection and Considerations
2. Follow site-specific and WFBH sample collection policies and procedures. If no site-specific policy or procedure exists, refer to the section below and Clinical Laboratory-Department of Pathology sample collection procedures (Intranet-Department of Pathology Handbook).
3. Prior to collecting any sample for i-STAT testing, the patient’s identity should be verified by the WFBH identification bracelet.
4. Use (2) patient identifiers
5. Verification of patient identification by staff may be completed using the patient’s full name and date of birth, and comparing that information to the document label on the paper or electronic chart.
6. Medical record number may also be utilized, if necessary, as a patient identifier.
7. The patient or patient’s family should be utilized in the patient identification process, when appropriate. Follow all WFBH policies and procedures regarding sample identification.
8. If the i-STAT testing is performed away from the patient’s bedside, the blood sample should be labeled in the presence of the patient. Label with a patient identification sticker, which should, at a minimum, include the patient name and medical record number.
9. Ensure correct patient identity throughout the entire testing process.
10. To ensure quality blood gas results and to avoid contamination by air, place an airtight cap on the end of the syringe, immediately after collection. Excess air in the sample should be expelled prior to mixing the sample and prior to capping the sample.
11. Needles should not be recapped.
12. Gloves should be worn.
13. When using blood gas syringes with liquid heparin, extreme care should be taken to avoid sample dilution/contamination from the liquid heparin.
14. ACT samples: Follow all current manufacturer recommendations.
15. ACT testing is used to monitor patients receiving heparin for treatment and certain medical procedures.
16. Only venous or arterial samples should be used for ACT testing.
17. Must be collected in a plastic syringe without anti-coagulant and tested immediately after collection.
18. A metal needle should not be used during cartridge fill.
19. If sample testing is delayed, results will be adversely affected.
20. i-STAT analyzers are programmed to read kaolin ACT’s in the pre-warm mode and Celite ACTs in the on-warm mode.
21. The i-STAT analyzer should not be moved or subjected to any vibration during sample testing. Results may be adversely affected. Keep the analyzer flat and free of movement.
22. Ionized Calcium: Follow all current manufacturer recommendations.
23. For ionized calcium, use balanced or low volume heparin sample collection containers (syringes, capillary tubes, or blood collection tubes).
24. Balanced heparin or 10 IU/mL lithium heparin is recommended.
25. Collection containers should be filled to correct sample fill capacity to avoid binding of ionized calcium by heparin.
26. Incomplete filling/ under filling of the sample collection container causes higher heparin to blood ratio, which will falsely decrease ionized calcium results and may affect other results.
27. In-Dwelling Line
28. Back flush line with sufficient amount of blood to remove intravenous solution, heparin, or medications that may contaminate the sample. Recommendation: five to six times the volume of the catheter, connectors, and needle.
29. ACT Coagulation Cartridges: If blood must be drawn from an indwelling line, possible heparin contamination and specimen dilution should be considered.
30. The line should be flushed with 5mL of saline and the first 5mL of blood or six dead space volumes of the catheter should be discarded.
31. Accurate results depend on an adequate back flush to eliminate the possibility of sample contamination with IV fluids.
32. Caution should be taken when collecting from lines which have had fluids that could adhere to the sides of the tubing. These lines may be difficult to adequately back flush.
33. Arterial Specimens
34. Avoid or immediately remove any air drawn into the syringe to maintain anaerobic conditions.
35. b. Samples should be capped immediately after collection to avoid air contamination.
36. Mix blood and anticoagulant by rolling the syringe between palms for at least 15 seconds.
37. Roll syringe for 5 seconds one direction.
38. Then roll for 5 seconds in the other direction.
39. Then invert for 5 seconds.
40. Ensure adequate sample mixing.
41. Venous Specimens: Follow current manufacturer recommendations
42. As appropriate per manufacturer’s instructions, if cartridge cannot be filled immediately, collect the sample in a heparinized evacuated blood collection tube. A syringe containing balanced heparin may also be used.
43. Fill collection containers to capacity.
44. Mix blood and anticoagulant by rolling the tube/syringe between palms for at least 15 seconds.
45. Roll syringe for 5 seconds one direction.
46. Then roll for 5 seconds in the other direction.
47. Then invert for 5 seconds.
48. Ensure adequate sample mixing.
49. Specimen Labeling
50. Unless the specimen is analyzed immediately after collection at the patient’s side/bedside and then discarded, the specimen should be labeled in the presence of the patient with the following information:
51. Full patient name
52. At least one of the following:
53. Medical Record number
54. Date of Birth
55. Specimen Identification Entered into the Analyzer
56. Patient samples are identified in the i-STAT by the patient’s WakeOne Contact Serial Number (CSN). As applicable, this information should be taken directly from the patient armband on the patient.
57. Any i-STAT result that has a valid CSN entered in the handheld analyzer will be automatically ordered, billed, and resulted to the permanent electronic health record (EHR). It is crucial that sample identification be entered correctly into the i-STAT handheld analyzer at the time of sample testing.
58. If the Medical Record/CSN/Patient Registration Number is not available at the time of i-STAT sample analysis, alternate means of sample identification should be used. See below:
59. Use the i-STAT generic ID. Current version contains 11 zeros and an alpha character at the end—for example 00000000000A, 00000000000B, 00000000000C Z-Number. This is a temporary ID#, specifically used for i-STAT testing.
60. Enter the number into the i-STAT as the patient ID number.
61. Log the ID used on the patient flow sheet and i-STAT Resolution Requisition.
62. Be sure that the ID used is noted on the patient care flow sheet maintained in the user site.
63. During your same-day shift, do not use the same generic ID for multiple patient samples.
64. Do not use the same generic ID for a multiple-patient transport.
65. Send the properly completed i-STAT resolution requisition to the POCT office as soon as correct patient identity is available.

* A copy of the results should be attached to the resolution requisition.
* It is very important to complete an i-STAT Resolution Requisition and send to the POCT office.
* Otherwise, the i-STAT results do not get posted to the patient’s electronic health record.
* NOTE: Use the correct CSN for subsequent samples as soon as one is available. The admission CSN must be used for inpatient samples.

1. Sample Identification During Sterile Procedures
2. During sterile procedures, the armband on the patient may not be accessible. If the armband is not accessible during a sterile procedure, adhere to the following process:
3. Print extra patient armband that matches the armband that is on the patient.
4. If the patient has been admitted, the inpatient admission armband must be used.
5. The extra armband must be verified against the armband that is on the patient, including:

* Full Patient Name
* Date of Birth
* Medical Record Number
* CSN

1. Verification of the second armband should be documented on the down-time form during down-time procedures.
2. This extra armband can be used to scan patient ID into the i-STAT analyzer, only during sterile procedures.
3. Once the case is completed, the extra armband should be destroyed.
4. Sample Misidentification
5. Immediately correct the results in the electronic health record using Enter/Edit functionality. Notify physicians of all affected patients.
6. An i-STAT Resolution Requisition should be completed and sent to the POCT office immediately.
7. E-mail resolution to [LabPOC\_Testing\_DL@wakehealth.edu](mailto:LabPOC_Testing_DL@wakehealth.edu)
8. The i-STAT analyzer should also be downloaded. This allows results to be editable in the electronic health record.
9. An RL6 report should be submitted and the RL6 report number provided to the POCT office.
10. Refer to the i-STAT appendix, ‘i-STAT Misidentification Protocol’ for specific details.
11. It is the responsibility of testing personnel to return i-STAT Resolution Requisitions, as necessary.
12. If there are instances when results cannot easily be traced to the correct patient, it will be the responsibility of the point of care contact person in each user site to work with the Clinical Laboratory POCT Coordinator to resolve such issues.
13. Procedure for Analysis
14. A documented order or protocol, submitted by an authorized provider, should exist for any patient i-STAT testing.
15. The order/protocol should be traceable to the patient health record.
16. Cartridge preparation for use: All cartridges should equilibrate to room temperature prior to use. Individual cartridges may be used after standing at room temperature for 5 minutes. A box of 24/25 cartridges should stand at room temperature for one hour before use.

* Ensure cartridges have not been exposed to unacceptable room temperature (<64ºF or >86ºF), prior to patient use.

1. Sample Testing Procedure
2. Gloves should be worn during entire sample collection and testing process.
3. Face shield protection should be available in each test site.
4. The analyzer should be programmed, prior to collection of the blood sample. This is extremely important when testing coagulation cartridges (PT/INR, ACT).
5. Select the desired cartridge and confirm the cartridge is not expired. Check the expiration date.
6. Turn on the analyzer.
7. Select ‘2-i-STAT Cartridge.’
8. Scan or manually enter operator ID.
9. To scan ID, hold ‘Scan’ and scan the barcode reader over the bar-coded operator ID.
10. Confirm that information scanned by the analyzer is correct.
11. Notify the POCT office if erroneous ID scanning occurs.
12. If the operator ID is manually entered, the ID must be entered twice to ensure accurate entry.
13. Testing personnel should not share ID numbers.
14. Scan or manually enter the patient ID.
15. To scan ID, hold ‘Scan’ and scan the barcode reader over the bar-coded patient armband.
16. Confirm that correct information is scanned by the analyzer.
17. Notify the POCT office if erroneous ID scanning occurs.
18. If the patient ID is entered manually, the ID must be entered twice to ensure accurate entry.
19. Accurate patient ID should be confirmed throughout the entire test process. As applicable, the ID entered into the i-STAT analyzer should come directly from the patient armband.
20. Scan the cartridge barcode information. IMPORTANT NOTE: You must use the cartridge from the pouch barcode that was scanned into the analyzer. This barcode contains important calibration information that is needed for an accurate testing process. If you cannot use the cartridge of the pouch that was scanned, you must start over from the beginning with the testing process.
21. Information scanned into the i-STAT analyzer will stay programed in the analyzer for 15 minutes, then the analyzer turns off.

* CAUTION: Laser Radiation—do not stare into the beam (Class 2 product- Laser Diode 650nm Maximum Output 1.0mW).

1. Collect the blood sample
2. Remove residual air bubbles in the end of the collection container and cap the sample immediately after collection to avoid air contamination and erroneous results.
3. Open the pouch. Remove the cartridge from the pouch and use immediately.
4. Place the cartridge on the pouch or other absorbent material.
5. Avoid touching the contact pads or exerting pressure over the calibrant pack in the center of the cartridge.
6. Samples should be properly mixed immediately prior to testing.
7. If a sample is not properly mixed, results may not be accurate.
8. Hematocrit results are adversely affected by improperly mixed samples.
9. If the sample is not adequately mixed or the filled cartridge sits for any period of time, inaccurate hematocrit results may be obtained.
10. As applicable, carefully squirt out a few drops of sample to confirm no sample clotting, to remove any residual air in the end of the syringe/capillary, and to facilitate smooth movement of the syringe plunger.

* Do not test samples that have or have had evidence of clotting.

1. Fill the test cartridge.
2. Direct the syringe, dispensing tip, capillary tube, or finger to the sample well of the test cartridge.
3. Dispense the sample until it reaches the fill mark on the cartridge.
4. Do not use force to fill the i-STAT cartridges. The cartridges should fill easily by capillary action. If resistance is encountered, stop the fill process and check for a clot in the sample. If force is used while filling the i-STAT cartridges, blood spatter may occur.
5. Leave a small blood dome at the sample fill well.
6. After the cartridge is properly filled, carefully close the cover over the sample well until it snaps into place.
   * Do not lean over cartridge while snapping cover—shield with gauze or use eye protection as necessary in case of splash back.
7. Do not press over the sample well. Inspect the cartridge to be sure any visible blood has been wiped off. Do not allow blood to seep into the analyzer.
8. As applicable, recap the sample so integrity is maintained in case of needed repeat testing (not applicable for coagulation tests).

* Do not re-cap needles.

1. Insert the cartridge into the cartridge door until it clicks into place.
2. ‘Cartridge locked’ will display on the analyzer screen.
3. Do not try to remove a cartridge when ‘cartridge locked’ is displayed. Damage to the analyzer may occur.
4. Do not move the analyzer during the testing process.
5. For analyzers programmed with Operator Test Select, an additional screen will appear. The user should numerically select the desired tests to be performed and press the ‘right arrow’ soft keypad to move forward to the next screen.
6. NOTE: When testing blood gas cartridges, TCO2 must be selected for display of HCO3 results.
7. NOTE: For cardiopulmonary bypass patient samples, select CPB hematocrit correction, as necessary. Refer to i-STAT System Manual for detailed information regarding the CPB hematocrit correction.
8. Enter additional parameters (if required):
9. FIO2 can be entered as the number of liters or as a percentage of the oxygen a patient is receiving.
10. Choose the number corresponding to the sample type used when prompted at the ‘Sample Type’ field. Press ENT.
11. Depending on the test performed, after 2 minutes, results will be displayed on the i-STAT analyzer.
12. Results should be evaluated for good sample quality, abnormal and critical values, and suppressed results.
13. Use Comment Codes, as appropriate. Comments codes better ‘automate’ result hold or posting to the patient record—must be entered at the time of testing for affect.
14. Comment Codes—For i-STAT
    * 0 translates to—Procedure Error

* Results flagged with comment code 0 will not post to the patient electronic healthcare record.
* This code should be used when the staff member does not believe the result and feels an error was made in testing.
  + 5 translates to—Recheck/Confirm
* Results flagged with comment code 5 will post to the patient electronic healthcare record, but the patient will not be billed for testing.
  + 6 translates to—Notify Provider
  + 123 translates to—Lab Confirmation to Follow
* Results flagged with comment code 123 will post to the patient electronic healthcare record, but the patient will not be billed for testing.

1. Document results and report to the appropriate personnel, according to user site specific guidelines.
2. Results may be printed. See ‘Reporting Results’ for the procedure.
3. Remove the test cartridge at any time after the ‘cartridge locked’ prompt disappears.
4. Discard the used cartridge in a container designated for biohazard materials.
5. Once a cartridge is removed, the analyzer is ready to accept another cartridge.
6. Download the results to the electronic health record as soon as possible.
7. Alternative Procedures
8. Should a problem occur with the i-STAT analyzers or cartridges in a user site, contact the POCT office at ext. 1-2421.
9. If extra analyzers are not available, specimens for blood gas, whole blood electrolytes, ionized calcium, and hematocrit analysis should be collected and submitted to the main lab.
10. Other chemistry or hematology testing may be sent to the clinical laboratory via pneumatic tube system or via courier.
11. Results

* Calculations: The i-STAT analyzer contains a microprocessor that performs all calculations required for reporting results. Refer to the i-STAT System Manual for calculated parameters.

1. Reference Ranges (Normal Ranges):
2. Reference ranges are the normal analyte ranges, as defined by the

Abbott IFU (information for use) cartridge sheet. This information is found on the Abbott website.

1. Test results that fall outside of these ranges exceed the normal value range for a normal population.
2. These results should be handled according to user site specific guidelines or physician orders.
3. Values Outside the Analyzer Reportable Range:
4. Values outside the reportable range of the i-STAT system have not been documented as being accurate.
5. Such values should be evaluated for accuracy. Consider repeat testing via an alternate method with a freshly drawn specimen.
6. See below for additional details.
7. Suppressed Results - There are three conditions under which the i-STAT System will not display results:
8. Out of Instrument Range
9. Results outside the system’s reportable ranges are flagged with a ‘<’ or ‘>’, indicating that the result is below the lower limit or above the upper limit of the reportable range, respectively.
10. If a result is dependent upon another result that is outside of the reportable range of the analyzer, the results will be suppressed and display as <>.
11. See the table of Reportable Ranges.
12. Action:
13. If contamination is a possibility, recollect and retest on another cartridge.
14. Otherwise, consider sending specimens to the Clinical Laboratory as outlined in ‘Alternative Procedures.’
15. Submit patient credit requests or use analyzer comment codes, as necessary.
16. QC Failed Parameters (\*\*\*—Star Outs)
17. Individual parameter results, which are not reportable based on internal QC rejection by only the parameter noted with the flag (\*\*\*) is affected. Other reported results are not affected by the QC rejection (\*\*\*).
18. NOTE: Star out results will be sent to the electronic health record if the comment code 0 is not entered into the analyzer at the time of testing. These \*\*\* results will report as ‘Instrument Error’ in the electronic health record.
19. Action:
20. If comment code 0 is used so all results on the test cartridge are held from the patient record, repeat using a new cartridge and blood sample. A new blood sample must be obtained if testing ACT or CG4 (lactate).
21. If a parameter still results as ‘\*\*\*’, consider that an interfering substance may be present, or there may be a cartridge problem that needs to be investigated.
22. A specimen may be sent to the Clinical Laboratory as outlined in ‘Alternative Procedures.’
23. The results that are not suppressed can be used and should be reported in the usual manner.
24. Submit patient credit requests, as necessary.
25. Instrument/Cartridge Problem (Quality Check Code)
26. Results will not be reported if a test cycle has a problem with the sample, calibrant solution, sensors, and mechanical or electrical functions of the analyzer.
27. Action:
28. Take the action displayed with the message that identifies the problem.
29. Refer to the i-STAT System Manual-Technical Bulletin- ‘Analyzer Coded Messages’ for assistance.
30. Critical Values:
31. Critical results are test results that fall outside high and low critical limits which define the boundaries of life-threatening values for a test.
32. Critical results represent an emergency condition and should be reported immediately to the patient’s attending physician, nurse, or mid-level provider. Follow WFBH policy regarding critical value notification and documentation.
33. The analyzer will flag potential critical values with bold black arrows.
34. Documentation of notification should be noted in the patient record. Documentation should include:
35. Notifying individual’s name/signature
36. Critical Result
37. Date
38. Time
39. Name of the person that is notified of the critical value
40. The author’s name should be legible and authenticated. Documentation pertaining to the person that is notified of the critical value should be identifiable for future questions. At a minimum, last name and credentials should be documented. It is preferred that the full name of the provider be documented.
41. Results that are verbally reported need to be confirmed by verbal reading back of results.
42. Unexpected critical values should be followed-up with appropriate repeat testing by an alternate methodology.
43. Unexpected Results
44. Any result that is obtained and is unexpected or not consistent with patient presentation should be tested by an alternate method.
45. If contamination is suspected, repeat testing with a freshly collected specimen.
    * Submit patient credit requests or use analyzer comment codes, as necessary.
46. If analyzer/test system performance is in question, try using a different lot number/box of cartridges and a different analyzer.
47. When unexplained discrepant results are noted, the POCT office should be notified immediately.
48. Result are only as good as the sample used, and quality may be affected by:
49. i-STAT hemoglobin and hematocrit results may be affected by improper sample mixing, total protein values, and other factors. Refer to the i-STAT System Manual for detailed information.
    * NOTE: Extreme caution should be exercised if using i-STAT hemoglobin and hematocrit results for transfusion decisions.
50. Drawing a specimen from an arm with an IV
51. Stasis (tourniquet left on longer than two minutes before venipuncture)
52. Extra muscle activity (fist pumping)
53. Icing sample before filling cartridge
54. Time delays before filling cartridge
55. Exposing the sample to air when measuring pH, pCO2, or pO2.
56. ACT results may be adversely affected by using a metal needle to fill the test cartridge or moving the analyzer during sample testing. The analyzer should be level with display facing up during testing.
57. Hemolysis, caused by alcohol left over the puncture site, a traumatic draw, or forceful flow of blood through a needle, can affect the quality of results.
58. i-STAT tests whole blood. Hemolysis cannot be determined when testing via i-STAT.
59. Hemolysis will falsely elevate potassium results.
60. Hemolysis is defined as the destruction of red blood cells, caused by disruption of the cell membrane, and results in the release of hemoglobin in the sample.
61. To determine the presence of hemolysis, the sample must be spun in a centrifuge and the plasma/serum layer observed for pink to red color.
62. The intensity of red color is proportional to the amount of hemolysis that is present in the sample.
63. Do not report/treat high potassium results until verified via an alternate method.
64. The sample should be checked for hemolysis.
65. Interferences:
66. Refer to the cartridge and test information sheets in the i-STAT System Manual for a detailed listing of interfering substances. Any time questionable results are obtained on the i-STAT, interfering substances should be considered.
67. Most common interferences
68. It has been determined that Propofol, Thiopental Sodium and Hydroxyurea can cause interference with the i-STAT test system. Results from patients receiving these drugs should be evaluated with caution. See the i-STAT System Manual-Cartridge and Test Information section for specific details.
69. Increased patient lactate may interfere with certain i-STAT results.
70. Hemodilution of the plasma by more than 20%, associated with priming cardiopulmonary bypass pumps, plasma volume expansion, or other fluid administration therapies using certain solutions, may cause clinically significant errors in sodium, chloride, ionized calcium and pH results.
71. Reporting Results: Results should be reported to the clinical provider in a timely manner.
72. Transmitting results to the Electronic Health Record
73. i-STAT 1 Analyzers should be downloaded after each patient test.
74. Test results obtained during procedural cases should be downloaded immediately following completion of the procedure.
75. Place analyzer in the downloader.
76. ‘Waiting to Send’ and then ‘Communication in Progress’ will display on the analyzer screen.
77. All unsent results will automatically transmit.
78. Do not move the analyzer until message disappears.
79. If the analyzer display indicates that there are unsent results:
80. Check all plug connections and repeat the download process.
81. If unsuccessful after 3 attempts, contact the Help Desk for assistance.
82. i-STAT handheld analyzers should be downloaded at an alternate site until issue is resolved.
83. Clerical Errors:
84. Patient Sample Misidentification—Refer to Appendix C for additional detailed instruction
85. If an error is discovered in identifying the patient sample, immediately notify providers of affected patients.
86. Once the i-STAT analyzer is downloaded, results will automatically populate the electronic health record.
87. It is imperative that incorrectly identified results be corrected immediately. The testing staff member is responsible for correcting the electronic health record.
88. An i-STAT Resolution Requisition must also be completed and sent to the POCT office.
89. **How to Correct Finalized POCT results if posted to Wake One: See** [**Appendix G**](#Appendix_G)
90. Staff Education and Competence:
91. Staff members who have been trained and demonstrated competency may perform this test. Current regulatory standards will be followed.
92. All operators must read the procedure manual and demonstrate successful i-STAT testing under the direction and supervision of an authorized staff member. Once successful demonstration of testing has been performed, it will be documented on the employee’s training checklist.
93. An authorized staff member will assess competency annually, and at 6 months of the first year, using the following 6 elements:
94. Direct observation of routine patient test performance, including as applicable, patient identification and preparation; and specimen collection, handling, processing, and testing.
95. Monitoring the recording and reporting of test results, including as applicable, reporting of critical results.
96. Review of intermediate test results or worksheets, quality control records, proficiency testing results, and preventative maintenance records.
97. Direct observation of performance of instrument maintenance and function checks, as applicable.
98. Assessment of test performance through testing previously analyzed specimens, internal blind testing samples or external proficiency testing samples.
99. Evaluation of problem solving skills
100. Any testing staff member that fails to meet the competency requirements will be re-educated by an authorized staff member at that location or by the POCT Compliance staff, prior to performing additional patient testing.
101. Product Information
     * Abbott Technical Support: 1-800-366-8020, including after hours, weekends, and holidays.
102. Review/Revision/Implementation
103. Review Cycle: Every 2 years
104. All new policies, procedures, guidelines, and those that have major revisions must be reviewed and signed by the CLIA Laboratory Medical Director.
105. All reviewed procedures and procedures with minor revisions can be signed by the designated section medical director or section manager.
106. Office of Record: Clinical Laboratory, Point of Care Testing Compliance

**Related Policies, Procedures, and Guidelines**

Understanding of Responsibilities Between Testing Sites and the Clinical Lab for POCT

Non-Waived POCT Quality Management Policy and Quality Control/Quality Assurance Procedure

Handling of POCT Analyzers when Removed from Service or Returned to Manufacturer for Repair

Competency Assessment for Non-Waived POCT

Point of Care Waived & Non-Waived Testing

Department of Pathology, Proficiency Testing Procedure

# References

1. College of American Pathologists (CAP) Lab Accreditation Program Lab General, All Common, and Point of Care Testing checklists, CAP, 325 Waukegan Road, Northfield, Illinois, 60093-2750, Revised July 2015
2. i-STAT System Manual, i-STAT Corporation, 303 College Road East, Princeton, New Jersey, 08540 Art #714446-00P Updated November 2019
3. National Kidney Disease Education Program websites: [www.nkdep.nih.gov/professionals/gfr\_calculators/idms\_con.htm](http://www.nkdep.nih.gov/professionals/gfr_calculators/idms_con.htm) & [www.nkdep.nih.gov/professionals/gfr\_calculators/orig\_con.htm](http://www.nkdep.nih.gov/professionals/gfr_calculators/orig_con.htm)

# Attachments

[Appendix A](#Appendix_A): Critical Results

[Appendix B](#Appendix_B): Quality Control/ Quality Assurance Procedures

[Appendix C](#Appendix_C): i-STAT Misidentification Protocol

[Appendix D](#Appendix_D): i-STAT Cartridge Sign-Out Procedure

[Appendix E](#Appendix_E): Reference Ranges & Reportable Ranges

[Appendix F](#Appendix_F): Other Associated Forms & Documents

[Appendix G](#Appendix_G): Correct Finalized POCT Results

# Related procedures/policies and Attachments/Linked documents in Navex/Policy Tech and/or title 21:

**Appendix A: Critical Results**

**Appendix B: Reference Ranges and Reportable Ranges**

**Appendix C: i-STAT Cartridge Sign-out Procedure**

i-STAT Supply Inventory Form

Complications Associated with Arterial Puncture Education Module

Complications Associated with Arterial Puncture – Training Documentation

i-STAT Ambient Room Temperature Log

i-STAT Cartridge Sign Out Log

i-STAT Resolution Requisition Form

i-STAT EG7 Cartridge IFU

i-STAT CG4 Cartridge IFU

i-STAT ACT-Celite Cartridge IFU

***Temperature and Humidity Monitoring for Reagents, Equipment and Environments in Clinical Areas***

***Point of Care Waived and Non-Waived Testing***

***Responsibilities of Testing Sites and the Clinical Laboratory for POC Testing***

***Competency Assessment for Non-Waived Testing***

***QC Range Verification***

***Non-Waived POCT Quality Management Policy and Quality Control/Quality Assurance Procedures***

***Handling of POCT Analyzers when Removed from Service or Returned to Manufacturer for Repair***

***Proficiency Testing***

***Managing Inventory for Expired Reagents, Point of Care***

***i-STAT Cartridge Receipt Process***

***i-STAT New Analyzer Receipt Process***

# Revision Dates: Review Change Summary as represented in Title 21.

# Revision Dates

1/23

4/23

# Appendix A: Critical Results

Critical results are test results that fall outside high and low critical limits, which define the boundaries of life-threatening values for a test. Critical results represent an emergency condition and should be reported immediately to the patient’s attending physician, nurse, or mid-level provider. Documentation of notification should be noted in the patient record. Documentation should include: notifying individual’s initials or signature, the result, date, time, and the name of the person that is noted of the critical value. The author’s name should be legible and authenticated. Documentation pertaining to the person that is notified of the critical value should be identifiable for future questions. At a minimum, last name and credentials should be documented. It is preferred that the full name of the provider be documented. Critical values should be properly evaluated with the patient’s clinical symptoms and followed-up as necessary with laboratory confirmation. Any unexpected result should be repeated on the i-STAT or sent to the laboratory for confirmation.

Critical value limits are defined by the Clinical Laboratory and, in conjunction with, the Medical Directors for i-STAT user sites.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Analyte** | **Adult** | **Pediatric** | **Neonate**  (Patient in NICU) | **Comments** |
| **Sodium**  mEq/L or mmol/L | <120 >160 | <120 >160 | <120 >150 | - |
| **Potassium**  mEq/L or mmol/L | <3.0 >6.0 | <3.0 >6.0 | <3.0 >6.0 | Unexpected results >6.0 should be verified by the laboratory. Hemolysis falsely elevates results. For potassium results to be considered critical, they should also fail the normal range defined for the patient’s age. |
| **Total CO2**  mEq/L or mmol/L | <10 >40 | <10 >40 | <10 >40 | - |
| **Ionized Calcium**  mmol/L | <0.75 >1.40 | <0.75 >1.40 | <0.80 >1.40 | - |
| **pH** | <7.2 >7.6 | <7.15 >7.6 | <7.20 >7.45 | - |
| **pCO2**  mm/Hg | <25 >60 | <30 >80 | <35 >80 | - |
| **pO2**  mm/Hg | <50 >200 | <30 >200 | <30 >200 | <30/50 Arterial;  >200 all sample types (does not apply to OR/ECMO circuit arterial samples) |
| **Glucose**  mg/dL | <50 >600 | <50 >300 | <50 >300 | - |
| **Hemoglobin**  g/dL | ≤6 ≥ 20 | ≤6 ≥ 20 | ≤6 ≥ 20 | - |
| **Hematocrit**  %PCV | ≤18 ≥60 | ≤18 ≥60 | ≤18 ≥60 | - |

# Appendix B: Quality Control & Quality Assurance Procedures

1. Purpose

Quality control (QC) checks, quality assurance (QA), and quality improvement (QI) activities are important to ensure the test system is functioning properly and to ensure quality results. i-STAT utilizes an internal simulator (QC) check, every 8 hours of use per cartridge type. The i-STAT analyzer is programmed to automatically perform the internal electronic simulator every 8 hours. External liquid QC is also tested to validate the test cartridges. Various activities, as described below, are used to validate performance of the test system.

1. Procedure
2. Quality Control Materials
3. Internal Electronic Simulator
4. External Electronic Simulator
5. Liquid Quality Controls—Performed by testing personnel.

Refer to the appropriate package insert and i-STAT System Manual for additional handling information and details.

1. i-STAT Liquid Tri-Controls—Used to verify the blood gas, hematocrit, chemistry, and electrolyte sensor performance.
2. Store at 2º to 8ºC (35º to 46ºF) through package expiration date.
3. Controls may be stored at room temperature (18º to 30ºC or 64º to 86ºF) for five days.
4. Do not use after expiration date on the box and ampules.
5. Protect fingers with gauze or tissue when opening vial.
6. If oxygen is being tested, QC material should be equilibrate to room temperature for 4 hours prior to use. Test sample immediately after opening.
7. ACT Liquid Controls—Used to validate performance of i-STAT ACT test cartridges.
8. CAUTION: Handle using standard precautions. This product contains human plasma.
9. Store at 2º to 8ºC through package expiration date.
10. Equilibrate at room temperature for 45 minutes prior to use.
11. Refer to package insert or i-STAT System Manual for additional reconstitution information. Carefully follow timing instructions.
12. Other Controls

As i-STAT develops more cartridges, a need ma exist for additional quality control materials. Details will be included as an appendix at the end of this document or the QC-specific package insert or the i-STAT System Manual may be referenced for details.

1. Calibration

Calibration is automatically performed as part of the test cycle on each cartridge. Operator intervention is not necessary.

1. Procedures Performed by the User Site
2. Analyzer Verification
3. Internal Electronic Simulator (Daily Quality Control)
4. To verify performance, each i-STAT analyzer will automatically perform an internal electronic simulation every 8 hours of use for each different cartridge type. The internal electronic simulation is activated when a filled test cartridge is inserted into the analyzer. The automatic electronic simulator option is activated and programmed by the POCT office, via the i-STAT data management system, when an analyzer is placed into service.
5. The simulator is a circuit in the analyzer, when enabled, verifies the electrical measurement of the analyzer and performs the same functions as the external electronic simulator.
6. If 8 hours have elapsed since the last electronic simulator test, the analyzer will automatically perform the internal test before the sample is analyzed. 15-20 seconds will be added to the test cycle.
7. If the simulator test fails, the fail result will be displayed on the analyzer screen, and the sample will not be analyzed.
8. Action for failed electronic simulator:

* Repeat the electronic simulation test by inserting another test cartridge or run the external electronic simulator QC device.
* Analyzers are programmed with ‘QC Lockout’. Results will not be given to the user, unless the QC/simulator check is acceptable.
* The i-STAT System Manual should be consulted for assistance.
* If the analyzer does not pass the external electronic simulator testing, contact the Clinical Laboratory POCT office for assistance.

1. Action for passing electronic simulator:

* If the internal electronic simulator passes, patient testing continues and gives results in the standard way.
* When the internal simulator is run, the ‘pass’ message will not be displayed on the analyzer screen. The QC record will appear in the analyzer’s memory and will be transmitted to the i-STAT data manager when the analyzer is downloaded.

1. External Electronic Simulator (as needed, quality control)
2. Test the external electronic simulator in the following circumstances:
3. If the internal QC check fails
4. If the analyzer is dropped
5. If the analyzer performance is in question
6. If a quality check code indicates that the simulator should be tested.
7. Store at room temperature and protect contact pads from contamination by placing the simulator in its protective case.

* Note: Do not remove the simulator while ‘Simulator Locked’ is displayed on the analyzer screen. Damage may occur to the analyzer. It is safe to remove the simulator when the ‘Simulator Locked’ message disappears from the display screen.

1. Action for failed electronic simulator:
2. Repeat the procedure with a different external electronic simulator or contact the Clinical Laboratory POCT office.
3. If ‘fail’ is displayed with the second electronic simulator, do not use the analyzer for patient testing.
4. Return the analyzer to the POCT office.
5. Use another analyzer for patient testing.
6. Action for passing electronic simulator:

* If ‘pass’ is displayed, the analyzer may be used for patient testing.

1. QC Documentation

Both the internal and external simulator test results are stored as distinct QC records in the analyzer and will be downloaded into the i-STAT data management system when patient data is transmitted. QC data is reviewed by the POCT office staff. Follow-up action is taken as necessary for QC failures.

1. Cartridge Supply Check (Performed by test sites)
2. Room temperature cartridges are stored with each device in each user site.
3. Prior to patient use, verify that cartridges are within manufacturer and/or room temperature expiration dating.
4. Follow manufacturer instructions for room temperature storage.
5. Cartridge expiration dates should be checked. Using an expired cartridge could jeopardize patient care.
6. The expiration date of each cartridge should be stamped or written on the outside of the cartridge pouch.
7. Always use the oldest date first to avoid loss of cartridges due to expiration.
8. Return any expired cartridges to the POCT office.
9. If the room temperature exceeds 30ºC (86ºF) for any period of time, quarantine the cartridges and notify the POCT office. Do not use the cartridges.
10. Do not allow supplies to get critically low.
11. Verification of Cartridge Storage Conditions
12. Refrigerated Cartridges
13. Notify the POCT office if any expired cartridges are found and pull them from patient issue stock. The cartridges should be labeled as ‘Do Not Use for Patient Testing.’
14. Daily, verify that the refrigerator did not exceed the limits of 2º to 8ºC (35º to 46ºF).
15. Document the temperature in the appropriate temperature log.
16. Action: If the temperature of the cartridge storage refrigerator is within range of 2º to 8ºC, dispense cartridges as required.
17. Action: If the temperature is outside of 2º to 8ºC:
18. Quarantine the cartridges in the storage refrigerator.
19. Notify the POCT office immediately.
20. Do not use the cartridges from the out-of-control refrigerator for patient testing.
21. i-STAT Tech Support may be contacted for assistance and liquid quality control checks may be performed to verify cartridge performance.
22. Record the temperature failure in the appropriate log, along with the action taken to resolve the problem.
23. Refrigerated Cartridges—Stored in user site refrigerators (performed by user site testing personnel)
24. Prior to patient use, verify that the cartridges stored in the refrigerator are all within the expiration date printed on the boxes.
25. Deliver any expired cartridges to the POCT office.
26. Daily, verify that the refrigerator did not exceed the limits of 2º to 8ºC (35º to 46ºF).
27. Document the temperature on the applicable refrigerator temperature log.
28. Action: If the temperature of the cartridge storage refrigerator is within the range of 2º to 8ºC, use the cartridge as required.
29. Action: If the temperature is outside of 2º to 8ºC:
30. Quarantine the cartridges in the storage refrigerator.
31. Notify the POCT office immediately.
32. Do not use the cartridges from the out-of-control refrigerator.
33. Adjust the temperature and recheck in one hour.
34. Record the temperature failure on the temperature log, along with the action taken to resolve the problem.
35. Analyzer Cleaning and Decontamination
36. The analyzer must be disinfected between each patient use.
37. Anytime an analyzer becomes visibly contaminated with blood, it should be sanitized with an anti-microbial cleaning agent to prevent the spread of infection between patients.
38. Use a fresh solution of 10% bleach or WFBH approved disinfectant.
39. Do not attempt to clean inside of the cartridge port. This may cause damage to the probes.
40. Return internally contaminated analyzers to the POCT office.
41. Contaminated analyzers should be treated as any other biohazard substance, i.e. use standard precautions when handling.
42. Follow WFBH policies and procedures for cleaning, disinfection, and discarding of supplies.
43. Liquid Quality Control
44. Liquid Quality Control (LQC) is used to verify the integrity of the test cartridges. Appropriate liquid controls should be used to test all analytes. Refer to the i-STAT System Manual for the most current list of available liquid controls.
45. New Cartridge Shipments: LQC checks verify the acceptable integrity of the i-STAT cartridges when they are received from the manufacturer. LQC should be tested on each lot number of each cartridge type received.
46. i-STAT cartridges are shipped refrigerated with a temperature indicator to monitor temperature during transit. The record of receipt is checked and documented.
47. If all windows are white, or if only the ‘A/1’ or ‘B/1’ windows have changed color, then transit temperatures were satisfactory.
48. If any or all of the ‘C/3’ or D/4’ windows have changed color:
49. Quarantine the suspect cartons.
50. Notify the POCT office immediately, who in turn, will contact i-STAT Tech Support for assistance.
51. Do not use the cartridges from the suspect cartons.
52. Questionable Cartridge or Analyzer Performance: If the cartridge or analyzer performance is in doubt, then LQC checks may also be performed.
53. Monthly: Each month, test sites will perform LQC checks.
54. General Information for Testing Liquid Quality Control
55. The analyzer should be programmed to test quality control. Refer to i-STAT System Manual for instructions.
56. Use appropriate liquid controls that test all parameters on the test cartridges.
57. Follow manufacturer recommendations regarding QC performance and handling.
58. Refer to the i-STAT System Manual for additional information.
59. Random cartridges should be selected for quality control performance.
60. QC ampules for non-PO2 cartridges may be used once they have reached room temperature (approximately 30 minutes).
61. For best results, ampules, cartridges, and analyzers should be at room temperature.
62. QC material for PO2 should equilibrate to room temperature for 4 hours prior to use.
63. For blood gas and electrolyte QC, immediately before use, shake the ampule vigorously for 5 to 10 seconds to equilibrate the liquid and gases phases.
64. To shake, hold the ampule at the top and bottom with forefinger and thumb to minimize increasing the temperature of the solution.
65. If necessary, tap the tip of the ampule to send solution back into the bottom section of the ampule.
66. Protect fingers with gauze, tissue or glove to snap off the tip of the ampule neck.
67. Aspirate the liquid QC material into a pipette, capillary, or syringe. Aspirate from the bottom of the ampule. Do not contaminate the sample with air.
68. Immediately transfer the solution into a cartridge.
69. Immediately snap the closure on the cartridge sample well and insert it into an analyzer.
70. It is important not to expose the solution to room air since this will alter the results.
71. Compare the results obtained against the package insert values. Use the expected values published in the package inserts to verify the integrity of the cartridges.
72. Check that the lot number of the control ampule matches the lot number on the package insert. The software version (CLEW) listed on the QC range insert should also match the version that is installed in the i-STAT analyzer.
73. Results should be transmitted to the i-STAT data management system.
74. Action: If all results are within the expected ranges, use the cartridges as needed.
75. Action: If any results are outside the published expected ranges:
76. Enter comment code 5 in the handheld analyzer.
77. Repeat the QC check and if the failure continues:

* Do not use cartridges from the suspect lot.
* Quarantine the suspect lot.
* Notify the POCT office immediately.
* Document action taken to resolve the problem.
* Note: The analyzer will not lock-out patient testing if liquid QC values are not within acceptable limits.

1. Staff must ensure liquid QC values are within acceptable range or ‘pass’
2. If QC fails—patient testing should stop.
3. The testing staff member should begin troubleshooting procedures.
4. Patient results may not be accurate if QC does not perform as expected.

* Never report patient results on a failed quality control event.

1. If a staff member proceeds with patient testing on a failed QC event, then the test site is out of compliance. Patient safety may be at risk.
2. Quality Assurance Review-Performed by the POCT Office or Designee
3. Check the i-STAT data management system for any results that did not get sent to the electronic health record. Results should be evaluated for the following circumstances:
4. The results should be evaluated for proper identification.

* The results are checked to determine if ID modification is necessary, i.e. generic ID number or patient misidentification.

1. ‘\*\*\*’ or star out results are evaluated for necessary reporting and will be documented on the ‘Star-Out Log’ on our non-waived checklist.
2. Evaluate results flagged with comment code 0.
3. Electronic simulator results are reviewed, using the i-STAT data management system.

* When an electronic simulator is noted as ‘failed’, the electronic simulator results are evaluated to confirm appropriate action was taken.

1. Quality check codes are reviewed
2. Quality check codes are monitored, via the i-STAT data management system, to check for trends in cartridge or analyzer performance.
3. If there are recurrent and unexplained quality check codes, i-STAT Technical Support may be contacted for resolution of the problem.
4. Quality Assurance (QA) reports are monitored for results that are outside of pre-defined limits (out of instrument range or critical values).
5. Results that report as ‘Out of Instrument Range’ are also reviewed for validity.
6. Any result that could be inaccurate, invalid, or indicate poor operator technique is investigated accordingly and appropriate action taken, as necessary.
7. When problems are noted, communication is sent immediately to user sites in the form of memos/e-mail documentation for user review.
8. As necessary, quality assurance (QA) reports are sent to user site supervisors or managers for follow-up of problematic issues.

1. Troubleshooting
2. Refer to the i-STAT Technical Bulletin ‘Analyzer Coded Messages’ for troubleshooting information.
3. The i-STAT ceramic cartridge may be used to correct certain error codes. Refer to i-STAT Technical Bulletin, ‘Analyzer Coded Messages’ for specific details.
4. For technical assistance with the i-STAT system:
5. Contact the designated super user or site preceptor
6. Call the POCT office at extension 1-2421
7. Call i-STAT technical service at 1-800-366-8020 after hours, weekends, or holidays.
8. Proficiency Testing (PT)
9. Non-waived Point of Care i-STAT testing, which is considered our primary test method and subscribes to a proficiency testing program uses the High Point Medical Center CLIA certificate (CLIA ID 34D0897682). This i-STAT testing does participate in bi-annual comparison testing with the main laboratory and blood gas lab to verify performance of the i-STAT test method and to cross check CAP samples used for departmental comparisons.
10. Users should follow instructions provided with the survey samples. Current accrediting and regulatory standards are followed. The proficiency samples are rotated among different users. There is no communication between the Clinical Laboratory and POCT sites regarding specific result values until after the proficiency provider submission deadline. If proficiency survey sample results fail, the problem is investigated and resolved as necessary, including re-training and evaluating instrument performance and survey sample handling. Follow-up and corrective actions are documented. Samples will be handled as follows:
11. All proficiency testing samples in the kit should be tested on the same day.
12. Proficiency testing events should be rotated among testing personnel each calendar year, if possible.
13. A goal, but not a requirement, is to follow this rule: At least one proficiency testing event—per year—per staff member when possible. Managers will keep track of personnel proficiency testing to make sure that one person is not always performing the proficiency testing.
14. A proficiency testing event should be handled the same as a patient sample, so analyzer selection should be based on patient sample workflow. The analyzer used for proficiency testing is not assigned. The analyzer used is at the discretion of the testing staff member when this is the workflow for patient samples.
15. Employee Certification, Training, & Competency

Employee training documentation is completed upon training on the i-STAT system. Each user of the i-STAT system should be trained prior to using the device for patient testing and should maintain updated competency records. Competency is assessed annually and at 6 months the first year. Current regulatory standards will be followed. Any user that fails to meet the competency requirements will need to be re-educated on use of the system. The Clinical Laboratory POCT office and user site managers maintain training and competency records.

# Appendix C: i-STAT Misidentification Protocol

1. Purpose

A patient-specific Contact Serial Number (CSN) is used to identify patient samples in the i-STAT analyzer. Sample identity should be confirmed and verified throughout the entire testing and result reporting process. If a patient sample is identified by the incorrect CSN, the results could post and bill to the incorrect patient. This could result in inappropriate treatment of a patient. Extreme care should be taken in entering the patient’s identification number into the i-STAT analyzer. If a sample misidentification is recognized, the following procedures should be followed. Patient sample misidentification should be documented via RL6 reporting.

1. Procedure
2. User Site
3. If the analyzer has not powered down and the results allow entry of a comment code, use comment code 0. This will prevent results from posting to the electronic health record (Wake One) or billing to the patient.
4. Download the analyzer.
5. Notify providers of affected patients. Clearly explain what occurred with the testing.
6. If comment code 0 was not used, results will post to Wake One and must be corrected.
7. In Wake One, open the patient chart.
8. Go to ‘Enter/Edit Results’.
9. Select ‘Point of Care Testing Docked Device’.
10. Radio button ‘All’.
11. Enter the date range. Click ‘Accept’.
12. Highlight the results that need edit. Double click to open the edit screen. It is very important that you ensure you select the correct test results for edit.
13. At Component Value (the results), replace ‘All i-STAT values’ with ‘XXX’. If a comment is present, ‘XXX’ out the comment as well.
14. In one of the comment sections for each set of results, enter this text: ‘Invalid result. Patient sample misidentification. Notified’ enter the full name of the provider that was notified with credentials and the date and time of notification ‘by’ the name of the person that notified the provider.
15. Click ‘Accept’
16. File an RL6 report. Email the RL6 number to the POCT office at [LabPOC\_Testing\_DL@wakehealth.edu](mailto:LabPOC_Testing_DL@wakehealth.edu)
17. Fill out an i-STAT Resolution Requisition (POCT website under Forms & Records). Complete all requested information. Include a copy of the results which need to be corrected.
18. Send the resolution requisition to the POCT office, via email to [LabPOC\_Testing\_DL@wakehealth.edu](mailto:LabPOC_Testing_DL@wakehealth.edu)
19. Ensure that result printouts or other documentation in the user site are corrected.

* It is the responsibility of the staff member who creates a sample misidentification to ensure site specific documentation and notification of appropriate personnel is completed.

1. Laboratory

As appropriate, test results should be resulted on the correct patient’s electronic health record.

1. Appropriate credit for tests should be issued to the misidentified patient.
2. Sample misidentification issues will be reported via RL6.
3. The site manager is responsible for follow-up action regarding these occurrences.

# Appendix D: i-STAT Cartridge Sign-Out Procedure

1. Purpose

Each user site is responsible for obtaining i-STAT cartridges and supplies. This procedure serves as a guide for non-laboratory staff and i-STAT user sites, regarding appropriate means of issuing and obtaining i-STAT supplies.

1. Procedure
2. Each user site should designate someone to maintain adequate i-STAT supplies.
3. The cartridges with the oldest expiration date should be used first.
4. The cartridges are kept refrigerated, per manufacturer’s instructions.
5. The cartridges should be at room temperature prior to patient use. An individual cartridge is ready to use after sitting at room temperature for 5 minutes. A full box of 24/25 cartridges should sit at room temperature for 1 hour prior to patient use.
6. Once cartridges are removed from the refrigerator, an appropriate room temperature expiration date should be noted on each individual cartridge.
7. Note: Room temperature expiration dating should never exceed manufacturer refrigerated expiration dating.
8. Creatinine cartridges—14 day room temperature expiration date
9. PT/INR—14 day room temperature expiration date
10. ACT-Celite—14 day room temperature expiration date
11. ACT-Kaolin—14 day room temperature expiration date
12. Chem 8—14 day room temperature expiration date
13. G3—2 month room temperature expiration date
14. CG4—2 month room temperature expiration date
15. EG7—2 month room temperature expiration date
16. Other cartridges—Refer to i-STAT System Manual
17. Each box of cartridges that is removed from the refrigerator should have the following information:

* Room temperature expiration date should be written on the package and should not exceed the package expiration date.

1. It is the responsibility of the testing personnel to ensure an adequate supply of i-STAT cartridges are maintained.
2. User Site Refrigerated Cartridges
3. If a site stocks refrigerated cartridges, the refrigerator temperature must be monitored and reviewed with corrective actions documented.
4. The refrigerator must be maintained within i-STAT’s current recommended temperature range. Refer to the cartridge packaging for correct refrigerated storage temperature range.
5. Replacement Analyzers & Printers
6. i-STAT sites should deliver faulty analyzers or printers to the POCT office.
7. As appropriate, laboratory personnel may issue a replacement device. The serial number (located on the back of the device) should be documented.
8. The POCT office or laboratory personnel will document the following:
9. Label the faulty device with ‘Do not use.’
10. Note the user site that returned the device.
11. Leave the faulty device in the POCT office.
12. Leave a note documenting the replacement device serial number that was issued to the user site.

# Appendix E: Reference Ranges & Reportable Ranges

Reference (normal) range means the range of test values expected from 95% of fasting individuals presumed to be healthy. (Taken from the normal ranges of the Abbott i-STAT IFU and cartridge test information sheet System Manual.)

Reportable range means the range of test values over which i-STAT results have been shown to be valid. The following table contains the reference ranges and reportable ranges applicable to the i-STAT. Reference the i-STAT System Manual for information not listed in this document.

|  |  |  |  |
| --- | --- | --- | --- |
| **Analyte** | **Unit** | **Reference Range** | **Reportable Range** |
| **Sodium** | mEq/L or mmol/L | 18y: 135-145 | 101-177 |
| 2y: 136-143 |
| 0: 133-142 |
| **Potassium** | mEq/L or mmol/L | 18y: 3.5-5.3 | 2.06-7.89 |
| 9y: 3.5-5.5 |
| 5y: 3.5-5.0 |
| 1y: 3.5-5.5 |
| 3m: 4.0-6.5 |
| 1m: 4.5-7.5 |
| 7d: 4.5-7.0 |
| 0d: 3.8-6.2 |
| **Chloride** | mEq/L or mmol/L | 8y: 95-106 | 65-140 |
| 7d: 95-110 |
| 0d: 90-105 |
| **BUN** | mg/dL | 18y: 8-24 | 8-100 |
| 16y: 14-32 |
| 1y: 5-15 |
| 0d: 8-28 |
| **Glucose**  (serum/plasma) | mg/dL | 18y: 70-100 | 20-600 |
| 1m: 60-100 |
| 14d: 50-100 |
| 7d: 50-90 |
| 0d: 45-90 |
| **ACT**  (Activated Clotting Time)  (Kaolin Activated) | Seconds | Kaolin activated—pre-warm  non-heparinized 74-137 | 50-1000 |
| **ACT**  (Activated Clotting Time)  (Celite Activated) | Seconds | Celite activated—pre-warm  non-heparinized 84-139 | 50-1000 |
| **Creatinine** | mg/dL | 18y: 0.5-1.5 | 0.2-20.0 |
| 10y: 0.5-1.0 |
| 4y: 0.4-0.9 |
| 1y: 0.3-0.8 |
| 3m: 0.3-0.7 |
| 1m: 0.3-0.7 |
| 14d: 0.4-1.1 |
| **Analyte** | **Unit** | **Reference Range** | **Reportable Range** |
| **Creatinine** | mg/dL | 7d: 0.3-1.2 | 0.2-20.0 |
| 0d: 0.5-1.5 |
| **Ionized Calcium** | mmol/L | 1.00-1.30 | 0.25-2.50 |
| **pH** |  | Arterial: 7.350-7.450 | CG4: 7.00-7.70  EG7: 6.50-7.70 |
| Venous: 7.310-7.410 |
| Capillary: None Defined |
| **pCO2** | mm/Hg | Arterial: 35-45 | CG4: 15-106  EG7: 15-90 |
| Venous: 41-51 |
| Capillary: None Defined |
| **PO2** | mm/Hg | Arterial: 80-100 | CG4: 50-361  EG7: 66-361 |
| Venous: None Defined |
| Capillary: None Defined |
|  |  |  |  |
| **Hematocrit**  (Male) | %PCV | 18y: 42-52 | 15-75 |
| 12y: 37-49 |
| 6y: 35-45 |
| 2y: 34-40 |
| 6m: 33-39 |
| 3m: 29-41 |
| 2m: 28-42 |
| 1m: 31-55 |
| 14d: 39-63 |
| 7d: 42-66 |
| 1d: 45-67 |
| 0d: 42-60 |
| **Hematocrit**  (Female) | %PCV | 18y: 37-47 | 15-75 |
| 12y: 36-46 |
| 6y: 35-45 |
| 2y: 34-40 |
| 6m: 33-39 |
| 3m: 29-41 |
| 2m: 28-42 |
| 1m: 31-55 |
| 14d: 39-63 |
| 7d: 42-66 |
| 1d: 45-67 |
| 0d: 42-60 |
| **HCO3** | mmol/L | Arterial: 22.0-26.0 | 1-85 |
| Venous: 23.0-28.0 |
| Capillary: None Defined |
| **TCO2** | mEq/L or mmol/L | 22-30 | 10-50 |
| **BE** | mmol/L | Arterial: (-2)-(+2) | (-30)-(+30) |
| Venous: (-2)-(+3) |
| Capillary: None Defined |
|  | mEq/L or mmol/L | 10-20  Per i-STAT cartridge and test information sheet Art. 714182-00U | (-10)-(+99) |
| **SO2** | % | Arterial: >95 | 0-100 |
| **Hemoglobin**  (Male) | g/dL | 18y: 14-17.5 | 5.1-25.5 |
| 12y: 13-16 |
| 6y: 11.5-16.5 |
| 2y: 11.5-13.5 |
| **Analyte** | **Unit** | **Reference Range** | **Reportable Range** |
| **Hemoglobin**  (Male) | g/dL | 6m: 10.5-13.5 | 5.1-25.5 |
| 3m: 9.5-13.5 |
| 2m: 9-14 |
| 1m: 10-18 |
| 14d: 12.5-20.5 |
| 7d: 13.5-21.5 |
| 1d: 14.5-22.5 |
| 0d: 13.5-19.5 |
| **Hemoglobin**  (Female) | g/dL | 18y: 12.3-15.3 | 5.1-25.5 |
| 12y: 12-16 |
| 6y: 11.5-16.5 |
| 2y: 11.5-13.5 |
| 6m: 10.5-13.5 |
| 3m: 9.5-13.5 |
| 2m: 9-14 |
| 1m: 10-18 |
| 14d: 12.5-20.5 |
| 7d: 13.5-21.5 |
| 1d: 14.5-22.5 |
| 0d: 13.5-19.5 |
| **Lactate** | mmol/L | Arterial: 0.36-1.25 | 0.50-18.0 |
| Venous: 0.90-1.70 |

# Appendix F: Other Associated Forms & Documents

1. i-STAT System Manual—Provided with each software update
2. i-STAT Resolution Requisition
3. i-STAT Competency Observation Form
4. i-STAT Supply Inventory Form
5. i-STAT Cartridge Receipt Check Form
6. i-STAT Cartridge Sing-Out Logs
7. Ambient/Room Temperature Log for i-STAT Cartridges

# Appendix G: Correct Finalized POCT Results







