Tips for Successful Point-of-Care Testing

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Objectives

1. Describe opportunities for laboratory staff to partner with the health care team on POCT
2. Identify differences between nursing and laboratory perspectives
3. Review features on newer POCT devices that can improve the quality of test results
Hypothetical POCT Threats

• Moving testing to the bedside means fewer laboratory ordered tests
• Nursing performed POCT will eliminate the need for medical technologists
• Direct interaction of physicians with test results will reduce need for laboratory directors – no need to interpret the results
The Truth about POCT

• POCT introduces an additional technology
  – Different precision
  – Biases
  – Unique interferences

• POCT results do not necessarily agree with core laboratory results

• Quality concerns if manufacturers instructions and controls are not performed as required

• Additional testing is ordered when POCT results do not match core lab results or questions about the quality of results present - This is a problem for over-utilization
POCT Quality Issues

• Complaints about SMBG devices represent the largest number filed with the FDA for any medical device (by 1993, over 3200 incidents, including 16 deaths). Greyson J. Diabetes Care 1993;16:1306-8.


• Routine analysis of desktop cholesterol analyzers (British Clinics) demonstrated that 21% of QC samples were >1mmol/L (39 mg/dL) from the target mean and as many as 16% of patients were misclassified. Summerton AM, Summerton N Public Health 1995;109:363-7.
POCT ≠ Lab Glucose

• Method differences
• Calibration differences
• Whole blood to plasma considerations

• Central Laboratory – glucose hexokinase
• POCT – glucose oxidase or glucose dehydrogenase
• Blood Gas Analyzers – glucose oxidase
Blood Glucose Meter Precision

• 95% of results fall within ± 2SD

• Core Lab
  
  93.7 ± 0.9 mg/dL (1.0% CV)
  282.7 ± 1.9 mg/dL (0.7% CV)

• POCT
  
  49.0 ± 9.2 mg/dL (18.6% CV)
  283.0 ± 15.0 mg/dL (5.3% CV)

• Clinically the ADA has recommended glucose meters to have CV’s of <5% at all levels and accuracy to within 5% of a lab result. (1987)
Blood Glucose Monitoring Test Systems for Prescription Point-of-Care Use

Guidance for Industry and Food and Drug Administration Staff


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For questions regarding this document, contact Leslie Landree at leslie.landree@fda.hhs.gov, or at 301-796-6147.
Blood Glucose Meter

- 95% of results within ± 20% if >100 mg/dL (current ± 12% >75 mg/dL)
- 95% of results within ± 20 mg/dL if <100 mg/dL (current ± 12 mg/dL)
- Recent evaluation by FDA on patient samples:

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<tr>
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<th>&lt;100 mg/dL</th>
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<tr>
<td>&lt;20mg/dL</td>
<td>&gt;20mg/dL</td>
<td>&lt;20%</td>
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<tr>
<td>Meter A</td>
<td>0%</td>
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<td>Meter B</td>
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<td>14%</td>
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<td>Meter C</td>
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<td>6%</td>
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<tr>
<td>Meter D</td>
<td>4%</td>
<td>10%</td>
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- Currently marketed glucose meters fail to meet consensus criteria in the hypoglycemic range.

Point-of-Care Testing Case Study

• Complaint from Gen Med Unit that glucose meter read high (mid 500’s) but when insulin given patient became disoriented and next glucose was 36 mg/dL.

• POCT staff pulled meter, QC in, maintenance records/proficiency surveys OK, pt sample accuracy checked.

• 63 y/o African american female admitted for CABG. History: ESRD, hypercholesterolemia, CHF, sickle cell trait, NIDDM (diet treatment). Post CABG developed L arm thrombosis, lysis therapy and developed DVT of L leg with pulmonary involvement
Point-of-Care Testing
Case Study

• Day 0: (2 weeks post CABG)
  0130: shortness of breath, 2+ pitting edema L leg and arm
  1600: refused glucose level check
  2040: Glucose meter = 564 mg/dL
  2300 HO gave 14U insulin per Standing Order (351-400 = 8 units)

• Day 1
  0100 pt diaphoretic shakey, dextrose/OJ, gluc = 36 mg/dL
  0200 glucose normal

• Medical Records glucose:
  Day 0  0730  Lab 282  0845  Meter 273  (9 mg/dL, 3%)
  Day 1  0758  Lab 255  0800  Meter 270  (15 mg/dL, 6%)
  Day 2  0700  Lab 284  0800  Meter 321  (37 mg/dL, 13%)
  (in-house verification study 96% within 15% of lab)
Point-of-Care Testing
Case Study

• Lab panic policy: No record of lab sample glucose, >400
• Why a POCT at same time as morning chem panels?
• Why 2.5 hrs elapse before clinical action? POCT more costly than lab, enough TAT for lab result
• Standing insulin orders: Set to laboratory methods not POCT, no standard scale, varies between departments.
• With poor circulation, should fingersticks be performed on this patient?
• Good record keeping was essential to troubleshooting, the excellent maintenance, QC and medical records worked to determine that the problem was clinical vs analytical, but can’t rule out line-draw contamination!
Why is a Laboratorian Needed with POCT?

• To explain discrepancies
• To recommend specific POCT devices
• To advise which test to order for a patient – POCT or core laboratory
• To ensure the appropriate documentation and display of results after testing
• To assist in training and staff competency
• To ensure the quality of POCT
The Changing Role of the Laboratory

Traditional Lab

- Techs in the basement
- No windows
- Responsible for analytical workstation
- Sole interaction with physician by phone
- Little contact with patient care
The Changing Role of the Laboratory

POCT
- The lab as consultant
- The lab as educator
- Visible to clinical staff
- Part of the patient care team
- Valued for advice
- A key role as a resource in healthcare
POCT is an Opportunity!

• Once POCT is implemented, core laboratories have not seen their business disappear, rather volumes have increased due to
  – POCT device validations
  – Increased use of the lab as “reference” service
  – Follow-up of discrepant results
  – Quality Assurance activities

• POCT should not be viewed as a threat, but as an opportunity for the laboratory to take on new roles in healthcare
  – Laboratorian has skills as expert on test technical performance, appropriate test selection, test quality, and interpretation
  – Opportunity for increased visibility to patient care team
Teamwork

To succeed as a team is to hold all of the members accountable for their expertise

Mitchell Caplan (CEO of E* Trade Group)
Nursing and Technology

Optimism

• Easily assimilated into patient care
• More rapid clinical decision-making
• Decreased cost to patient

Cynicism

• Detracts from patient care
• Time- and labor-intensive for nursing
• Takes nurses away from the bedside
• Lab testing not viewed as traditional role for nursing
Nursing Roles

• Physical care

• Emotional care

• Spiritual care

• Lab Diagnostics?
Multidisciplinary Teams and Point-of-Care Testing

Nursing

Laboratory

Nursing outcomes

Laboratory outcomes
Interdisciplinary Teams and Point-of-Care Testing

Nursing  Laboratory

Patient outcomes
Interdisciplinary Team Approach

• Committee CoChairs - Nursing/Laboratory
• Pathology role as a facilitator
  – Propose a draft policies and procedures
  – Nursing identifies problems
  – Mutually discuss solutions
  – Incorporate solutions into program
• Each member contributes expertise and separate point-of-view
  – Laboratory - technical and regulatory
  – Nursing - patient focused
• Laboratory as “Knowledge Resource” vs “Dictator of Practice”
Role of Laboratory Staff

- Evaluate technology
- Correlate methods
- Define normal ranges
- Write protocols
- Manage instruments

- Coordinate supplies
- Provide back-up
- Oversee and document training
- Review compliance
- Supervise quality assurance
Role of Nursing Staff

• Determination of clinical pertinence
• Training and documentation of continued competency
• Performance of quality control checks
• Surveillance of patient results and quality monitors
• Day-to-day maintenance and activities
Quality Control & Proficiency Testing: Nursing Perspectives

• Nurses familiar with pre- and post analytical steps of laboratory testing
  – Specimen collection
  – Taking action on results - instituting treatments

• Less accustomed to analytical steps
  – Quality control
  – Proficiency testing
Quality Control & Proficiency Testing: Nursing Perspectives

Laboratory

- Restricted tasks
- Large test runs: “factory environment”
- Process oriented
  - Calibration
  - Accuracy
  - Precision

Nursing

- Broader responsibilities
- Limited test runs: “boutique environment”
- Outcome oriented
  - Time spent with patient
  - Patient goal achievement
Role of Leadership in Point-of-Care Testing

• Create a vision for clinical staff of importance/proper use of quality control and proficiency testing (Focus on “Why QC should be done” not “Must do QC”)

• Streamline quality assurance requirements to achieve goals with minimal resource consumption and maximum result and patient quality

• Write policies and procedures in nursing language not laboratory technical lingo
When to do POCT?
Clinical Justification

• Turnaround Time
• Vascular entry
  – Fingerstick versus phlebotomy
• Required part of housestaff training
• Practice Trends
  – Increased inpatient acuity
• Efficiency of Patient Care
  – Physician refamiliarization with case
POCT: Operator Criteria

- The best performing device may not be acceptable to clinical staff - Institutions should consider:
  - Ease of use
  - Portability
  - Volume requirements
  - Automatic calibration
  - Reliability, maintenance
  - Infection control
  - Cost

POCT: Minimizing Cost

• Increasing testing volume
  – POCT - High variable (reagents), low fixed (instrument)
  – Central - Low variable, high fixed
• Decrease non-patient testing (quality control:test ratio)
• Minimize operators, use lower paid staff
  – nurse vs physician, nurse’s aid vs RN
• Limit POCT to medical necessity, use lab for routines
• Justify cost with improved patient outcome
  – fewer inpatient days, less ICU time, etc.
• POCT tends to be an additional service rather than replacement for lab testing
Quality Improvement Compliance Indicators

- Documentation of daily maintenance
- Proficiency samples tested and results returned by due date
- Documentation of daily QC
- Meter coded correctly (strip code and plasma mode)
- Maintenance Log present
- Out-of-date controls and strip vials discarded
- Open date recorded on controls and strips
- Multiple vials of controls strips open at a time
- Meter cleanliness
Joint Commission/CAP
Improving Organization Performance

• **PLAN:** Formed Multidisciplinary Task Force for POCT
• **DESIGN:** Standardized POCT QA program
• **MEASURE:** Performance monitors
• **ASSESS:** Trends noted
• **IMPROVE:** Modify program to improve trends
• **PLAN:** Implement program changes
• **DESIGN:** New performance monitors
Components of a Quality POCT Program

• Inclusion of laboratory personnel as operators
• Inclusion of videotape as part of training
• Involvement of laboratory in training
• Repeat training and review performance at scheduled intervals
• Regular comparison of POCT results with clinical laboratory
• Storage of QC and patient data in POCT device

Jones BA, Howanitz PJ. Bedside glucose monitoring quality control practices: A College of American Pathologists Q-probes study of program quality control documentation, program characteristics, and accuracy performance in 544 Institutions Arch Pathol Lab Med 1996;120 339-45.
Quality Laboratory Testing

• Test results that are reliable
• Appropriate use of technology
• Documentation of results in medical record
• Compliance with accreditation guidelines
Quality

• Assumes an understanding of all of the processes that lead to the final product – the test result - and how the test will be used to manage patient care

• How to guarantee consistency of process and quality of results?

• Need to take quality beyond the laboratory perspective and liquid QC results –
  – Why the test was ordered?
  – What is the instrument performance?
  – What does result mean?
  – How will the result be used in patient care?
POCT Design Flaws
POCT Dilemma

• POCT requires significant operator interaction unlike other medical devices
• Requirement for operator decision-making (QC in range, temp monitored, reagents expired)
• Clinicians interpret POCT as equivalent to core lab tests, only faster, and utilize the results interchangeably.
• More than 50% of POCT is manual, visually interpreted colorimetric tests
• Manual processes are prone to error
Man

A creature made near the end of the week when God was tired.

Mark Twain
Medical Errors

• 2002 Commonwealth Fund report estimated that 22.8 million people have experienced a medical error, personally or through at least one family member
• Reinforces the 1999 IOM report, “To Err is Human”
• Annual costs estimated at $17 – 29 billion
• US Agency for Healthcare Research and Quality (AHRQ) estimate medical errors are the 8th leading cause of death in the US – higher than:
  – Motor Vehicle Accidents (43,458)
  – Cancer (42,297)
  – AIDS (16,516)
Reducing Errors through Automation

- Manual processes are prone to error
- Newer POCT devices have data management
- Prompts operator to perform testing same way every time
- Reduces practice variability (device prompts)
- Consolidates operator interactions (barcoding)
- Assists decision-making (internal checks for QC pass, expiration dates, operator ID)
- Lock-outs act as internal “fail-safes” to prevent a patient result if QC fails, not performed or operator is not certified for testing.
Medical Errors

• The Person
  • Easier to blame a person than an institution for errors.
  • In aviation, 90% of quality lapses are judged to be blameless.

• The System
  – Active failures due to personal interaction with system
  – Latent conditions, weaknesses in system due to design flaws or hierarchical decisions

• Need to engineer systems that prevent dangerous errors and are able to tolerate errors and contain their effects

Point-of-Care Testing

• There is no “perfect” POCT device, otherwise we would all be using it!

• Any device can and will fail under the right conditions

• A discussion of risk must start with what can go wrong with a test (errors or nonconformities)

• Lab tests are not fool-proof!
POCT

• Dozens of sites
• Hundreds of devices
• Thousands of operators!
• Too many cooks... spoil the broth!
• The number of sites, devices and operators plus the volume of testing creates a situation where rare events can become probable in every-day operations
## One Health System’s POCT

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<th>SITES</th>
<th>DEVICES</th>
<th>OPERATORS</th>
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<tr>
<td>PPM</td>
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</table>
POCT is a Complex System

• Laboratory
  – One site
  – Limited instrumentation to perform bulk of testing
  – Limited staff, focused on same equipment daily
  – Staff trained in laboratory skills

• POCT
  – Dozens of sites, hundreds of devices and thousands of operators
  – Staff are clinically focused on patient not on equipment
  – Staff do not have laboratory training background
  – Testing delegated to lower level staff (TAs, MAs)
Sample Errors: Interferences

• Analytic error
• Maltose (Glucose dehydrogenase PQQ) falsely increased results
• Acetaminophen falsely increased results on glucose dehydrogenase and falsely decreased results on some glucose oxidase meters,
• Vitamin C falsely increases results on some glucose dehydrogenase and falsely decreases results on glucose oxidase meters.
Fatal Iatrogenic Hypoglycemia: Falsely Elevated Blood Glucose Readings with a Point-of-Care Meter Due to a Maltose-Containing Intravenous Immune Globulin Product

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Center for Devices and Radiologic Health

INTRODUCTION

In July 2005, the Food and Drug Administration (FDA) received a case report of an elderly male diabetic patient who received a 10% maltose-containing intravenous immune globulin product (Cigam, Octapharma Pharmazeutika Produktionsges mbH, Vienna, Austria) and experienced hypoglycemic coma and irreversible neurological damage secondary to excessive insulin administration. His insulin dosing was guided by falsely elevated blood glucose measurements that were obtained from a point-of-care glucose meter (Accu-Chek Inform meter, Accu-Chek Comfort Curve test strips, Roche Diagnostics, Indianapolis, IN, U.S.). The glucose meter test strips used glucose dehydrogenase pyrroloquinolinequinone (GDH-PQ) methodology, which may overestimate measurements when blood maltose levels exceed 0.9 mmol/L.

Adverse events have been reported for immune globulin products that contain maltose, which functions as a protein stabilizer and an osmotic agent. Similar adverse events have been reported for Extraneal (Baxter...
Sample Errors: Interferences

• Minimize test interference at the bedside.

• Select technologies not affected by common medication interferences
• Watch for maltose, icodextrin, and other common substances like ascorbic acid known to interfere with glucose meters at elevated levels.
• Assess bias from oxygen and hematocrit effects.
Sample Errors: Interferences

- No current control process for hemolysis
- Problem with whole blood sampling on blood gas and electrolyte analyzers for K+
- One way to detect hemolysis... centrifuge all whole blood samples before reporting K+ to detect hemolysis and comment affected results!
- What about applying too much/too little sample?
Sample Errors: Specimen Volume

• Some glucose meters recommend that operators visually inspect strips for uniform color development after each test (detects underfilling and bubbles)
• Other meters have automate sample detection. (Fill-trigger is designed to prevent short-sampling.)
• Test starts only when enough blood has been applied.
Operator Errors: Training/Competency

• Operator lockout
• Functions through number code or barcoded ID
• List of operators and training/competency dates maintained in data manager system—
• Devices can warn operators of impending certification due dates (in advance of lockout)
• Newer U.S. CLIA Interpretive Guidelines requires 6 elements of competency for moderate complexity tests
  • Includes – 1 observe test performance, 2 result recording, 3 intermediary worksheets (QC, PT, maintenance), 4 observe maintenance, 5 analyze sample of known concentration, 6 problem-solving – Competency documentation not fully automated!

• Infrequent operator competency, need intuitive devices
• Note – operators can share ID numbers to access testing and override lockout!
Operator Errors: Performing QC

- Devices require periodic liquid QC
- Operators are patient focused and can forget to run QC, or fail QC targets, and proceed with patient testing.
- QC lockout shuts off patient testing if QC not performed or fails target ranges.
- Prevents patient testing unless QC documented
- Operators workaround QC lockout by performing patient testing in QC mode!
- Newer devices distinguish QC samples, prevent patient testing in QC mode and can also warn when operators run a high QC for low range QC and vice-versa.
Reagent Errors: Calibration

• Incorrect entry of calibration code can lead to inaccurate test results
• Devices have automatic calibration via barcode scanning of reagent vials/strips. (no code chips or risk of wrong calibrator codes)
Measuring System Errors: Contamination

• POC devices pose a risk of transmitting infectious organisms
• POC blood testing devices, such as glucose meters and PT/INR anticoagulation meters, should be used only on one patient and not shared.¹
• If dedicating POC blood testing devices to a single patient is not possible, the devices should be properly cleaned and disinfected after every use as described in the device labeling.¹
• POC devices need more durable plastics, fewer crevices and seams, and a design that prevents liquid egress into ports

Measuring System Errors: Contamination

• Reagents and carriers besides the devices can also transmit infectious organisms.\(^1,^2\)
• Recommendation to dedicate vials of strips to individual patients. Manufacturers should further consider single-use packaging.\(^1\)
• We estimated cost of dedicating strips based on survey of glucose monitoring in 100 inpatients.
  – Average number of 3.4 tests/day (1 – 7.2)
  – Average of 8.4 day length of stay (1 – 81 days)
  – 278 patients per day requiring glucose monitoring
• Annual cost of test strip waste ranged from >$80,000 for 25 count vials to >$170,000 for 50 count vials compared to single-use packaging. (Nichols JH. Estimated strip wastage from glucose meter infection control recommendations Clin Chim Acta 2012;414:91-2.)


Integrating POCT

• When should POCT be considered?
• How to implement?
• Many hospitals have core laboratory model with centralized testing
• Management of acute patients requires more rapid diagnostics – ED, OR, ICU
• Delays in transportation or processing drive need for POCT
• Health systems with outpatient clinics have more complex TAT issues that may drive POCT and menus different from inpatient care.
POCT Improves Patient Outcome

• Oncology Center – 2 blocks from hospital
• Patients need estimate of renal function before administration of chemotherapy
• Hematology laboratory onsite performs cell counts and simple chemistries (i-stat)
• Creatinine sent to core lab – periodic courier pickup (every 2 hours), means patients could wait up to 4 hours before testing completed
• Need faster turnaround time for results

POCT Creatinine

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<th>MDRD 60 mL/min</th>
<th>POC A vs Jaffe</th>
<th>POC B vs Jaffe</th>
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<td>100%</td>
<td>67%</td>
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<tr>
<td>Efficiency</td>
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<td>+ Predictive Value</td>
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<td>Efficiency</td>
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<td>POC B vs Enz</td>
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- POCT gave higher creatinine levels, called more patients abnormal.
- Physicians had to adjust their cutoff levels for management decisions to higher creatinine (lower GFR) when utilizing POCT compared to lab.
- POCT led to faster results and moved patients through clinic, resulting in increased patient and physician satisfaction.
POCT Improves Patient Outcome

• POCT creatinine improved patient care in our Heme/Onc clinic.
• Need for test, tied to technology, and management after test result (ie pharmacy utilized to estimate GFR and alter dose of medication)
• Test integrated into pathway of care
• Care is streamlined as treatment can follow as soon as result is available
• POCT is a different technology than core lab testing
• Clinical criteria may need to be adjusted based on the technical performance of the method
POCT Information Management

• POCT is a different technology
• Results are not equivalent to other laboratory methods without considering unique performance characteristics
• Electronic medical records overlay results of the same name, so physicians can trend tests over time.
• POCT results cannot be freely interchangeable with other methodologies and electronic reporting must keep results separate.
• Use of POCT flowsheets can help staff manually document POCT results.
### Laboratory Results

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(All values are in mg/dL or units as appropriate.)
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<td>Negative (Normal)</td>
<td>1+ Negative</td>
</tr>
<tr>
<td>Straw/Light yellow (Normal)</td>
<td>Clear (Normal)</td>
<td>Trace (100 mg/dl)</td>
<td>1+ small</td>
</tr>
<tr>
<td>Yellow (Normal)</td>
<td>Hazy (Normal)</td>
<td>1+ (250 mg/dl)</td>
<td>2+ moderate</td>
</tr>
<tr>
<td>Amber/Dark yellow (Normal)</td>
<td>Cloudy (Normal)</td>
<td>2+ (500 mg/dl)</td>
<td>3+ moderate</td>
</tr>
<tr>
<td>Green</td>
<td></td>
<td>3+ (&gt; cr = 1000 mg/dl)</td>
<td>3+ large</td>
</tr>
<tr>
<td>Pink</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Ketones</th>
<th>Specific Gravity</th>
<th>Blood</th>
<th>pH</th>
<th>Protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative (Normal)</td>
<td>&lt; or = 1005</td>
<td>Negative (Normal)</td>
<td>&lt; or = 8.0</td>
<td>Negative (Normal)</td>
</tr>
<tr>
<td>Trace (5 mg/dl)</td>
<td>1.010</td>
<td>Trace</td>
<td>5.0</td>
<td>Trace</td>
</tr>
<tr>
<td>1+ (15 mg/dl)</td>
<td>1.015</td>
<td>1+ small</td>
<td>5.5</td>
<td>1+(30 mg/dl)</td>
</tr>
<tr>
<td>2+ (40mg/dll)</td>
<td>1.020</td>
<td>2+ moderate</td>
<td>6.0</td>
<td>2+ (100 mg/dl)</td>
</tr>
<tr>
<td>3+ (80mg/dll)</td>
<td>1.025</td>
<td>3+ large</td>
<td>&gt; or = 9.0</td>
<td>3+ (300 mg/dl)</td>
</tr>
<tr>
<td></td>
<td>&gt; or = 1.030</td>
<td></td>
<td></td>
<td></td>
</tr>
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<table>
<thead>
<tr>
<th>Urobilinogen</th>
<th>Nitrite</th>
<th>Leukocytes</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2 mg/dl</td>
<td>Negative (Normal)</td>
<td>Negative (Normal)</td>
<td></td>
</tr>
<tr>
<td>1 mg/dl</td>
<td>Positive</td>
<td>Trace</td>
<td>&lt; or = 8.0</td>
</tr>
<tr>
<td>2 mg/dl</td>
<td>Trace</td>
<td>1+ small</td>
<td>5.5</td>
</tr>
<tr>
<td>4 mg/dl</td>
<td>2+ moderate</td>
<td>6.0</td>
<td>6.5</td>
</tr>
<tr>
<td>&gt; or = 8.0</td>
<td>3+ large</td>
<td>7.0</td>
<td>7.5</td>
</tr>
</tbody>
</table>

*Organization/CLIA #
Data Management Complexities

• No universal POCT data management like USB
• Added expense, most physician offices can’t afford:
  – Computer server
  – POCT data manager
  – Interfaces and annual maintenance fees
• Different POCT requires separate interfaces
• More than half of POCT is manual without data management features
This document provides the framework for engineers to design devices, work stations, and interfaces that allow multiple types and brands of point-of-care devices to communicate bidirectionally with access points, data managers, and laboratory information systems from a variety of vendors.

A standard for global application developed through the NCCLS consensus process.
**Multi-Vendor Data Managers**

![RALS Connectivity Without Limits](http://www.rals.com/DeviceInterfac...)

**RALS®-Device Interfacing Menu**

<table>
<thead>
<tr>
<th>VENDOR</th>
<th>DEVICE</th>
<th>RALS-PLUS</th>
<th>RALS-FREEDOM</th>
<th>COMMUNICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abaxis</td>
<td>Piccolo xpress</td>
<td>-</td>
<td>YES</td>
<td>Uni-directional</td>
</tr>
<tr>
<td>Abbott POC</td>
<td>i-STAT</td>
<td>YES</td>
<td>YES</td>
<td>Bi-directional</td>
</tr>
<tr>
<td>Accumenetics</td>
<td>VerifyNow</td>
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<td>YES</td>
<td>Uni-directional</td>
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<tr>
<td>Alere</td>
<td>Triage Meter Plus</td>
<td>YES</td>
<td>YES</td>
<td>Bi-directional</td>
</tr>
<tr>
<td>Alere</td>
<td>Triage Meter Pro</td>
<td>YES</td>
<td>YES</td>
<td>Bi-directional</td>
</tr>
<tr>
<td>Alere</td>
<td>epoc Blood Analysis</td>
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<td>Uni-directional</td>
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<td>Helena POC</td>
<td>Actalyke XL</td>
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<td>YES</td>
<td>Uni-directional</td>
</tr>
<tr>
<td>Hemocue</td>
<td>201 DM Glucose</td>
<td>YES</td>
<td>YES</td>
<td>Bi-directional</td>
</tr>
<tr>
<td>Hemocue</td>
<td>201 DM Glucose RT</td>
<td>-</td>
<td>YES</td>
<td>Bi-directional</td>
</tr>
<tr>
<td>Hemocue</td>
<td>201 DM HB</td>
<td>YES</td>
<td>YES</td>
<td>Bi-directional</td>
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<tr>
<td>IL</td>
<td>GEM Premier 3000</td>
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<td>YES</td>
<td>Uni-directional</td>
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<tr>
<td>IL</td>
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<tr>
<td>IL</td>
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<tr>
<td>ITC</td>
<td>AVOXimeter 4000</td>
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<td>YES</td>
<td>Uni-directional</td>
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<tr>
<td>ITC</td>
<td>IRMA TRUpoint</td>
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<td>YES</td>
<td>Bi-directional</td>
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<tr>
<td>ITC</td>
<td>ProTime</td>
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<td>YES</td>
<td>Uni-directional</td>
</tr>
</tbody>
</table>
Integrating POCT with Order Entry

• How do physicians know which test to order? POCT versus central lab?
• Educational pamphlet minimally effective
• More than a 10 fold difference in cost between a glucose by central lab, glucose meter, or BG POC
• Economic downturn forced us to reexamine clinical need for stat testing given cost differences
• Two initiatives to decrease inappropriate utilization
  – Change the name from i-Stat to POC cartridge
  – Prevent routine ordering of test
  – Pop-up window reminder
• Initiatives reduced POC cartridge usage by 50 - 60%
<table>
<thead>
<tr>
<th>ABG POC Cartridge</th>
<th>pO2 Venous POC Cartridge</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABG w/Lactate POC Cartridge</td>
<td>Potassium POC Cartridge</td>
</tr>
<tr>
<td>BUN POC Cartridge</td>
<td>Sodium POC Cartridge</td>
</tr>
<tr>
<td>Calcium Ionized POC Cartridge</td>
<td>VBG POC Cartridge</td>
</tr>
<tr>
<td>Chloride POC Cartridge</td>
<td>VBG w/Lactate POC Cartridge</td>
</tr>
<tr>
<td>CO2 Est Arterial POC Cartridge</td>
<td></td>
</tr>
<tr>
<td>CO2 Est Venous POC Cartridge</td>
<td></td>
</tr>
<tr>
<td>Creatinine POC Cartridge</td>
<td></td>
</tr>
<tr>
<td>Glucose POC Cartridge</td>
<td></td>
</tr>
<tr>
<td>Hematocrit POC Cartridge</td>
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</tr>
<tr>
<td>Hemoglobin POC Cartridge</td>
<td></td>
</tr>
<tr>
<td>Lytes (Na+K) POC Cartridge</td>
<td></td>
</tr>
<tr>
<td>O2 Sat Arterial POC Cartridge</td>
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</tr>
<tr>
<td>O2 Sat Venous POC Cartridge</td>
<td></td>
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<tr>
<td>Panel POC Cartridge</td>
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<tr>
<td>pCO2 Arterial POC Cartridge</td>
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<tr>
<td>pCO2 Venous POC Cartridge</td>
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</tr>
<tr>
<td>pH Arterial POC Cartridge</td>
<td></td>
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<tr>
<td>pH Venous POC Cartridge</td>
<td></td>
</tr>
<tr>
<td>pO2 Arterial POC Cartridge</td>
<td></td>
</tr>
</tbody>
</table>
For all POC Cartridge Orders
Priority is defaulted to Stat – can not be changed
No free text fields and can not type into Order Comments field
POC Cartridge testing is 10 times as expensive as routine and stat laboratory testing and 5 times as expensive as POC testing for glucose tests. BMC is the largest user of POC cartridges on the East Coast, adding significantly to our cost of care.

Please consider ordering a POC cartridge test only when there is an urgent need and avoid its use for routine and scheduled lab tests.

The indications for a POC Cartridge Test are:
- Emergent care of critically ill patient
- Severely anemic patients whom the Hgb is <8 g/dl
- Patient with excessive blood draws (>10 tubes drawn in last 24 hours)

‘Pop-Up’ text that appears automatically upon selecting a POC Cartridge order
Summary

- POCT is a complex workflow process
- The laboratory should work with nursing to best manage POCT quality
- Integrate POCT into existing clinical workflow
- Utilize available features on POCT devices to automate processes and improve quality
- Exploit data management for POCT as manual documentation is challenging to complete and review