Appendix A - Major Changes for Laboratory Medicine with Connect Care Fully Launched Sites

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A. Clinical Microbiology

• Ordering COVID-19 and other respiratory virus testing in Connect Care:

Use the "Respiratory Infection (inc. COVID-19) NAT" smart group.

- Select the patient presentation/encounter (Admitted or ED patient likely to be admitted; ED likely to be discharged; outpatient)
- Select the symptoms present (influenza-like illness (ILI); other COVID-19 symptoms; asymptomatic)
- "Rapid COVID-19 PCR" is automatically selected for all patients. All other orders must be selected if testing is indicated.
- If the patient has ILI:
    - If influenza or RSV is circulating, select "Rapid Influenza and RSV NAT"
    - If your site has ID NOW testing it can be ordered within the smart group if the patient meets criteria (symptomatic and presenting within 7 days of onset)
- The respiratory pathogen panel can also be selected if they meet the criteria listed
- A specific smart group with defaults set for ETT's/BAL's can be added to your preference list upon request if you order this testing on ETT's and BAL's more frequently than other specimen sources.

1. Pediatric Blood Culture

- Changes to the collection guidelines for pediatric blood cultures have been made to optimize the sensitivity of blood cultures and help identify true line infections vs. contaminants. Blood cultures should always be collected from two (2) sites in patients >30kg and is suggested for all patients except neonates.
- For patients weighing ≤30kg, use the "Blood Culture Panel-Pediatric (weight based)" order set.
  Bottles will be ordered and collected as follows:

Body Weight (kg)	**Site 1**	**Site 2**	**Number of bottles to be collected**
Less than or equal to 5 kg	Pediatric Bottle Minimum 1 mL		1
5.1 - 12.7 kg	Pediatric Bottle 4 mL	Pediatric Bottle 2-4 mL	1-2
12.8 kg - 30 kg	Aerobic + Anaerobic 10 mL + 10 mL	Aerobic 10 mL	2-3
Greater than 30 kg	Aerobic + Anaerobic 10 mL + 10 mL	Aerobic + Anaerobic 10 mL + 10 mL	4

- For patients weighing >30kg, use the "Blood culturesx2" regardless of patient age.

Ordering anaerobic culture

- Previously, clinicians could specifically request anaerobic culture when bacterial cultures were ordered. This is no longer necessary as the lab will automatically perform anaerobic culture when appropriate, based on the specimen type received.

B. Clinical Biochemistry

I. Standardization in Test Reporting

Random Urine Changes

- If Urine albumin result is below the detection limit of the method or greater than the measuring range, the albumin/creatinine ratio will be reported as "<X" or ">Y", where X and Y are numerical values for the lower or upper measuring range of urine albumin method divided by the creatinine concentration respectively.

24 hour Urine Changes

- Standardized acceptable time for 24 hour urine collection: 22 to 26 hours
- Standardized reporting units: unit/day (e.g. 24 hour urine urate to be reported as mmol/day)
- Urine electrolytes will include an anion gap
- If Urine protein >6.00 ratio will report as ">"

Anion Gap

- Standardization of reference intervals by instrument (Only Launch 5 sites included below):

Testing Site	Instrument	Reference Interval (mmol/L)
Red Deer Regional Hospital	Roche Cobas	4 – 16
Other Launch 5 sites	Abbott iSTAT	13 – 21
	Ortho Vitros	8 – 15

Bilirubin

- Standardization in available tests to order:
  - Bilirubin, Total
  - Bilirubin, Total and Conjugated
- Specific testing will follow when above tests are ordered based on patient age and instrument availability
- Both tests (Bilirubin, Total; Bilirubin, Total and Conjugated) will reflex to the Biliary Atresia protocol in the appropriate age group (7 days to 5 months)
  - Note: If age 0-6 days or age >5 months, conjugated bilirubin will be performed only if "Bilirubin, Total and Conjugated" is ordered

Electrolyte Panel

- Only one electrolyte panel is available. It consists of Sodium, Potassium, Chloride, CO2, and Anion Gap
- This full electrolyte panel is available at all locations (including community)
- The APL/DynaLIFE community requisition has been updated to only have check boxes for Sodium and Potassium. To receive the full electrolyte panel, 'Electrolyte Panel' should be written in on the requisition.

Glucose meter check

- This test is now available across the province and is intended to check the accuracy of patient's glucose meter against the lab glucose result, and will have three required order questions:
  - Fasting time
  - Patient glucose meter type
  - Patient glucose meter result

HIV Serology by Rapid Assay (Rapid HIV)

- This test is orderable in Epic as "HIV Serology by Rapid Assay"
- Process instruction on order screen:
    - Rapid HIV is intended for URGENT DIAGNOSIS of HIV for the indications listed in "reasons for testing". Order HIV 1 and 2 Serology (Antigen and Antibody) for routine diagnosis. For Blood and Body Fluid Exposures order "BBFE Panel".
- All rapid HIV results (non-reactive, indeterminate, reactive, Invalid) will reflex to a HIV serology test (confirmation test performed at ProvLab)
- There are now only four clinical indications for testing. They are listed as order questions:
    - Female in labor and delivery with no prenatal care or recent HIV testing
    - Acutely ill patient with HIV in the differential diagnosis
    - Person with HIV high risk behaviors, unlikely to return for results
    - Other (must specify)

IgE Allergy Testing

- Food Allergen Screen:
    - Testing discontinued
- Inhalant Screen:
    - Testing is available, but seasonal reflex panels for positive results have been discontinued
- Individual Allergen Specific IgE Tests:
    - See DynaLIFE Test Directory for available tests and IgE Allergy Testing Requisition
    - Lower limit of reporting dropped to 0.10 kU/L; cut-off for positivity remains the same at 0.35 kU/L

Ionized Calcium

- "Calcium, Ionized" and "Calcium, Ionized, pH adjusted" will be reported with standardized critical values: <0.80 mmol/L and >1.50 mmol/L
- Standardization of reference intervals by instrument has occurred for "Calcium, Ionized" and "Calcium Ionized, pH adjusted" (Launch 5 sites included below):

Testing Site	Instrument	Parameter	Age	Reference Interval (mmol/L)	Critical Values (mmol/L)
Red Deer Regional Hospital	IL GEM 3500	Calcium, Ionized	<29 days	0.9 – 1.3	<0.80, >1.50
			29 days – 150 years	1.15 – 1.35	
		Calcium, Ionized, pH adjusted	<29 days	0.9 – 1.3	
			29 days – 150 years	1.15 – 1.35	

Lactose Tolerance, 2 hours

- A cutoff of 1.1 mmol/L will be used to determine whether the test is normal or abnormal (the current inconclusive range of 1.1-1.7 mmol/L will be eliminated).
    - If a difference of 1.1 mmol/L glucose or greater from baseline to either the 30 min, 60 min, or 120 min time point is observed, the test result is NORMAL
    - If a difference of less than 1.1 mmol/L from baseline to ALL of the 30 min, 60 min, and 120 min time points is observed, then the result is ABNORMAL

- Standardization and recording of time to consume drink and drink dose:
    - If more than 5 minutes taken to drink the dose, the following comment will append to the report: *Drink consumed over X minutes, not the recommended 5 minutes. Interpret results with caution.*

Occult Blood, Stool

- A new standardized test comment will append to all fecal occult blood test results: "*Fecal Occult Blood Testing may be of limited clinical value due to potential interferences, especially if processed immediately after collection. The test result may be subject to interference from Vitamin C supplements (false negative), and dietary and/or medication interference (false positive).*"

Osmolal Gap

- There are three new orderable tests:
  - Osmolal Gap
  - Osmolal Gap, Unaccounted
  - Osmolality, Calculated
- Standardization for reporting of "Osmolal Gap, Unaccounted" by applying factor of 1.25 on the ethanol result
  - If ethanol <2, then zero will be used for ethanol to calculate "Osmolal Gap, Unaccounted"
- Osmolal Gap, Unaccounted will no longer reflex to differential alcohol screen testing (Test code: ALC).

Troponin

- This test code will order the troponin (conventional or high sensitivity) that is available at the local site to ensure quick turnaround time.
- A delta will be calculated for high sensitivity troponin method when there are consecutive measurements available, with the absolute difference in ng/L being reported on the patient chart.
- ONLY Outpatients/Community patients with critical troponin I (TnI) results (≥10 ug/L), high sensitivity TnI results (>99 ng/L) or high sensitivity Troponin T (TnT) results (>52 ng/L) will have their results phoned to the ordering physician.

II. Gender U and X

- Changes have been made to improve reporting of Gender U and X results when patients are resulted within a laboratory live on Connect Care. There are still challenges in legacy systems in adopting gender U and X which may be exacerbated if a patient has testing performed at multiple sites in the province since the legacy system may overwrite gender identity when they register a patient.
    - Tests that have different male and female reference intervals will have specific reference intervals designated for U and X and will include a reporting comment with the test result
- Examples from Clinical Biochemistry are provided below, Hematology parameters can be found later in this document.
    - Creatinine
      ≥ 15 years: 40-120 umol/L
      Patient identifies as gender X, or gender is unknown. The reference interval provided encompasses male and female ranges. Result should be interpreted in the context of the clinical history.

    - LH
      For patients ≥10 years the following comment will append:
      Reference Interval:
      Follicular < 15.0 IU/L
      Luteal < 15.0 IU/L
      Midcycle 30.0 – 100.0 IU/L
      Post Menopausal: 18.0 – 65.0 IU/L
      Male < 12.0 IU/L
      Patient identifies as gender X, or gender is unknown. Interpret result based on an appropriate reference interval listed above.

III. Clinical Biochemistry Reference Interval and Critical Value Standardization

a) Urinalysis

Current urinalysis reporting in Alberta uses multiple different instruments and reporting schemes, particularly for macroscopic (dipstick) reporting. With Connect Care, urinalysis will be standardized to align reporting across the province.

Major changes:

- Launch 5 sites are already reporting in SI units, so there is no change in reporting categories with Connect Care. The provincially standardized build for instruments at Wave 3 sites is shown below for reference.

	Connect Care Provincially Standardized Reporting		
Analyzer	**IRIS - Velocity**	**Clinitek**	**Reference Interval**
Performing Lab	Red Deer Regional Hospital	All other Launch 5 Sites	
Ascorbic Acid	1.14 mmol/L 2.28 mmol/L	Not applicable Not applicable	Not Applicable
Glucose	Negative Not applicable 2.8 mmol/L 8.3 mmol/L >=28 mmol/L	Negative 5.5 mmol/L 14 mmol/L 28 mmol/L >= 55 mmol/L	Negative
Ketones	Negative Not applicable 0.5 mmol/L 2.0 mmol/L >=7.8 mmol/L	Negative Trace 1.5 mmol/L 3.9 mmol/L >=7.8 mmol/L	Negative
Protein	Negative Not applicable 0.3 g/L 1.0 g/L >=3.0 g/L	Negative Trace 0.3 g/L 1.0 g/L >=3.0 g/L	Negative
Leukocyte Esterase	Negative 25 Leu/uL 75 Leu/uL 250 Leu/uL 500 Leu/uL	Negative 15 Leu/µL 70 Leu/µL 125 Leu/µL 500 Leu/µL	Negative
Blood	Negative Not applicable Not applicable 5-10 Ery/uL 50 Ery/uL 300 Ery/uL	Negative Trace-Lysed Trace-Intact 25 Ery/µL 80 Ery/µL 200 Ery/µL	Negative
Nitrite	Negative Positive	Negative Positive	Negative

Not Applicable: Indicates this value is not a reporting option by the analyzer/dipstick

*Clinitek reporting has been updated since Launch 1 to condense the previous categories of 'Trace-Intact' and 'Trace-Lysed' into one category called 'Trace'

- Urinalysis reporting has been standardized to use the same reference intervals and units for both macroscopic and microscopic reporting (See tables below)

Macroscopic Urinalysis Tests

Analyte	Reference Interval	Units
Blood, Urine	Negative	Ery/µL
Clarity, Urine	Clear	-
Color, Urine	Colourless, Yellow, Amber	-
Glucose Urine	Negative	mmol/L
Ketones, Urine	Negative	mmol/L
Leukocyte Esterase, Urine	Negative	Leu/µL
Nitrites, Urine	Negative	-
pH, Urine	5.0-8.0	-
Protein, Urine	Negative	g/L
Specific Gravity	1.005-1.030	-

Microscopic Urinalysis Tests

Component	Reference Interval	Units
RBC	0-2	RBC/HPF
WBC	0-5	WBC/HPF
Bacteria	0-20	Bacteria/HPF
Epithelial Cells	0-5	Epithelial Cells/HPF
Non-squamous epithelial cells	0-5	Non-squamous epithelial cells
Hyaline Casts	0-2	Hyaline casts/LPF
Other cast types	Absent	Casts/LPF
Crystals	Absent	Crystal/HPF
Yeast	Absent	N/A

- Ascorbic acid will be reported from samples analyzed on IRIS-velocity instruments. The presence of ascorbic acid can cause a false negative on the Blood macroscopic result.

b) General Chemistry Tests

There has been provincial standardization of reference intervals, critical values and/or units.
M = Male; F = Female; U = Unknown Sex; X = Gender X

Analyte	Age	Gender* (M, F, U, X)	Reference Interval	Units	Critical Value
Alkaline Phosphatase (ALP)	0 d – 14 d	M, F, U, X	70 – 320	U/L	None
	15 d – 364 d	M, F, U, X	130 –500		
	1 yr – 12 yr	M, F, U, X	130 – 430		
	13 yr – 14 yr	M	130 – 500		
	15 yr – 17 yr	M	60 – 250		
	13 yr – 14 yr	F	60 – 225		
	15 yr – 17 yr	F	50 – 140		
	13 yr – 14 yr	U, X	60 – 500		
	15 yr – 17 yr	U, X	50 – 250		
	18 yr – 150 yr	M, F, U, X	40 – 120		
Ferritin	0 d – < 6 mo	M, F, U, X	50 – 500	ug/L	None
	6 mo – 15 yr	M, F, U, X	15 – 100		
	> 15 yr	F	20 – 300		
		M	30 – 500		

		U,X*	20 – 500		
GGT	0 d – < 15 d	M, F, U, X	20 – 200	U/L	None
	15 d – < 1 yr	M, F, U, X	< 100		
	1 yr – < 18 yr	M, F, U, X	< 27		
	18 yr – 150 yr	F	< 50		
		M	< 80		
		U,X*	< 80		
Iron Saturation Index	0 d - <18 yr	M, F, U, X	0.10 – 0.15		None
	18 yr – 150 yr	M	0.12 – 0.60		
		F	0.10 – 0.55		
		U, X	0.10 – 0.60		
Lactate Dehydrogenase (LD)	0 d – 1 yr	M, F, U, X	200 – 420	U/L	None
	1 yr – 10 yr		140 – 320		
	10 yr – 15 yr		120 – 300		
	15 yr – 150 yr		120 – 250		
Lipase	0 d – 18 yr	M, F, U, X	<50	U/L	None
	18 yr – 150 yr		<80		
Osmolality, urine	0 d – 150 yr	M, F, U, X	50 – 1400	mmol/kg	
TSH	0 d – 8 d	M, F, U, X	1.23 – 25.00	mIU/L	None
	8 d – 1 y		1.00 – 6.80		
	>=1 yr		0.20 – 6.50		
Urea	0 d – 2 yr	M, F, U, X	1.0 – 7.5	mmol/L	None
	2 yr – 17 yr	M, F, U, X	2.0 – 7.0		
	18 yr – 55 yr	F	2.0 – 7.0		
		M	3.0 – 8.0		
		U, X	2.0 – 8.0		
	>55 yr	F	3.0 – 8.0		
		M, U, X	3.0 – 9.0		

c) Therapeutic Drug Monitoring and Toxicology Tests

- Acetaminophen (potential bilirubin interference) at all Launch 5 sites outside Red Deer Regional Hospital (Vitros Sites):
    - If acetaminophen ≥66 umol/L, a bilirubin is automatically reflexed. If bilirubin is >250 umol/L a comment is appended to the acetaminophen result:
        - Result(s) may be falsely increased. Specimen is icteric.
- There has been provincial standardization of reference intervals, critical values and/or units. See below table for standardized reporting information.

Analyte	Target Level	Units	Critical Value	Comment
Acetaminophen	Not applicable	umol/L	>250	*Consult Poison and Drug Information Service (PADIS) at 1-800-332-1414 if appropriate.*
Carbamazepine	17-50	umol/L	>65	
Digoxin	Heart Failure: 0.6 - 1.2 Atrial Fibrillation: Not defined Caution: Results > 1.5 nmol/L are associated with a higher risk of toxicity in heart failure patients (target level appended to result as a comment)	nmol/L	>2.6	
Gentamicin (Pre-Dose)	<2	mg/L	>1.9	*Note: If patient is receiving extended interval dosing the target trough is less than 0.5 mg/L. Dosing is 4 to 10 mg/kg and interval is 24h or more.*
Gentamicin (Post-Dose)	5-10	mg/L	>14.9 mg/L	
Gentamicin, 8h Interval	See Hartford Nomogram	mg/L	>10.9	*CAUTION: Specimen should be collected 7-9 hours after the START of infusion for proper interpretation. Refer to Hartford Nomogram (applies only to 7 mg/kg dose; if other dose used, obtain pharmacokinetic consult). Refer to Aminoglycoside Dosing/Monitoring Guidelines, AHS Bugs and Drugs Online Document.*
Gentamicin, Other	N/A	mg/L	>14.9	

Lithium	Acute mania therapy 1.00 - 1.50 Bipolar maintenance 0.60 - 1.20 Depression 0.30 - 0.60 (target level appended to result as a comment)	mmol/L	>2.00	
Phenytoin, total	≤ 3 months: 25 – 55 >3mo: 40-80	umol/L	≤ 3 months: >80 > 3 months: >120	*CAUTION: For IV drug administration, specimen must be collected 2 hours or more after end of dose for proper interpretation.*
Salicylate	N/A	mmol/L	>2.20	
Valproate	350 - 700	umol/L	>1040	
Vancomycin, Pre-Dose	10.0-20.0	mg/L	> 25.0	Vancomycin Levels greater than 15 mg/L increase risk of nephrotoxicity. Note: Vancomycin levels may be undetectable or falsely low in patients with elevated Immunoglobulins. Contact Laboratory Senior Staff to arrange for alternate testing if required. Routine monitoring of vancomycin levels is not generally recommended. Please refer to Vancomycin Dosing/Monitoring Guidelines, AHS Bugs and Drugs Online Document.
Vancomycin, Other	N/A	mg/L	>60.0	Note: Vancomycin levels may be undetectable or falsely low in patients with elevated Immunoglobulins. Contact Laboratory Senior Staff to arrange for alternate testing if required. Routine monitoring of vancomycin levels is not generally recommended. Please refer to Vancomycin Dosing/Monitoring Guidelines, AHS Bugs and Drugs Online Document.

Methanol/Ethylene Glycol

- An unaccounted gap will not be automatically performed when either methanol or ethylene glycol requested
- Progressive testing algorithm will be discontinued. Requests for methanol and ethylene glycol will proceed and will not be dependent on the unaccounted osmol gap

Change to comment associated with ethanol results.

- This result must not be used or disclosed for potentially medicolegal or other non-medical purposes.

For all Therapeutic Drug Monitoring (TDM)

- Order/collection questions: TDM dosing information (regimen/route/time of last and next dose/regimen duration).
- This request mirrors information collected on paper requisitions.
- Dosing information, if provided, will appear on the final report

Urine Drug Testing

- Order/collection question: Reason for Request. This request mirrors information collected on paper requisition.
- Order/Collection questions related to urine temperature. This is not a hard stop question but allows sites that are currently performing urine temperature to identify whether the temperature was acceptable.
- Order/Collection questions related to whether the patient presented with appropriate identification.
- There are 2 orderable drug testing panels:
  - Urine Opioid Dependency Panel – meant to be ordered for patients who are in Opioid Dependency Programs (also referred to as Opioid Agonist Therapy)
  - Urine General Toxicology Panel – ordered on patients other than those in Opioid Dependency Programs.
  - These panels are not new as they have been in place for over 2 years. However, the change may not have been readily apparent to sites utilizing an old version of the paper requisition.

d) Blood Gas Tests

Reference intervals and critical values were standardized for the province in preparation for Connect Care Implementation through Clinical Knowledge and Content Management (CKCM). The Working Group assigned to this was created in consultation with the Critical Care Strategic Clinical Network, the Provincial Respiratory Professional Practice Council, and Laboratory Point of Care Testing Network, with additional experts consulted as required.

See the **Point of Care Testing** section below, and refer to Blood Gas Standardization of Reference Intervals & Critical Values.

C. Point of Care Testing (POCT)

I. Connectivity of POCT devices

There are changes to result reporting for POCT devices that require workflow (Connect Care POCT Information Sheet) and clinical practice changes. A controlled connectivity

rollover of POCT devices to the POCT AegisPOC data management middleware, and then into Epic will occur in conjunction with Connect Care Launches. Results from POCT devices will either: 1) flow directly from the device through the new POCT middleware into the electronic medical record (i.e. connectable), or 2) be manually entered into AegisPOC so results can flow into Epic (i.e. non-connectable).

Connected device workflows:

- POCT Device Connect Care Workflows
  - Roche Accu-Chek Inform II Glucose Meter
  - Abbott i-STAT1 and i-STAT Alinity
- Mobile Integrated Health
- Radiometer ABL90 Flex Plus
- Siemens Clinitek Status Plus
- Werfen GEM 5000
- Siemens DCA Vantage
- Siemens CoaguChek XS Pro
- Werfen Avoximeter 1000E

Unconnected device workflows:

- POCT Workflows for Manual Test Methods
  - AegisPOC Launch Button Set Up for Manual Test Result
  - AegisPOC Manual Test Result Entry - AmnioTest
  - AegisPOC Manual Test Result Entry - AmniSure
  - AegisPOC Manual Test Result Entry - Drager Jaundice Meter
  - AegisPOC Manual Test Result Entry - Glucose Meter
  - AegisPOC Manual Test Result Entry - Hemocue 201
  - AegisPOC Manual Test Result Entry - Manual Urine Dipstick
  - AegisPOC Manual Test Result Entry - Siemens Clinitek Status
  - AegisPOC Manual Test Result Entry - Urine Drugs of Abuse Screen
  - AegisPOC Manual Test Result Entry - Urine Pregnancy
- **Additional AegisPOC Manual Test Result Entry Resource:**
  - AHS My Learning Link course: "POCT-AegisPOC Manual Test Result Entry"

II. All healthcare professionals/providers must adhere to the following when performing POCT:

- Be a Trained and Certified Clinical User of POCT
  - Completed POCT certification requirements to access or use all devices (manual or automated).
  - APL POCT will provide access to the POCT middleware system, AegisPOC, for result transmission or manual test result entry.
- Use your AHS employee ID barcode number to access POCT devices or to access the AegisPOC Manual Test Result Entry application.
- Use correct Epic patient identifier for POCT:
  - Use the correct Epic-generated patient ID encounter (Contact Serial Number **[CSN]**).

- Only the correct CSN will allow results to flow uninterrupted to the patient's Epic chart and Netcare.
- **Additional Connect Care CSN Resources:**
  - AHS POCT Playbook Work Package
  - AHS My Learning Link course: "POCT-Connect Care POCT Requirements"

III. POCT Reference Interval and Critical Value Standardization

a) Anion Gap

- Standardization of reference intervals by POCT device (Launch 5 sites included below):

Testing Site	Instrument	Reference Interval (mmol/L)
Mobile Integrated Health (MIH)	i-STAT	13 – 21

b) Ionized Calcium

- Standardization of critical values: <0.80 mmol/L and >1.50 mmol/L
  Standardization of reference intervals by POCT device for "Calcium, Ionized" and "Calcium Ionized, pH normalized" (Launch 5 sites included below):

Testing Site	Instrument	Reference Interval (mmol/L)
Cross Cancer Institute Mobile Integrated Health (MIH)	i-STAT	1.15 – 1.35

c) Macroscopic urinalysis

- Standardization of reference intervals:

Analyte	Reference Interval	Units
Blood, Urine	Negative	Ery/µL
Clarity, Urine	Clear	
Color, Urine	Colourless, Yellow, Amber	
Glucose Urine	Negative	mmol/L
Ketones, Urine	Negative	mmol/L
Leukocyte Esterase, Urine	Negative	Leu/µL
Nitrites, Urine	Negative	-
pH, Urine	5.0-8.0	-
Protein, Urine	Negative	g/L
Specific Gravity	1.005-1.030	-

Macroscopic Urinalysis Reporting

With each Connect Care Launch, all POCT urinalysis patient test results must be reported into the EPIC patient electronic medical record. This requirement applies to both **Manual** (dipstick, Clinitek Status) and **Automated** (Clinitek Status®+) testing. All reporting units for urinalysis

testing in EPIC have been standardized provincially to SI units, which provides a numerical result rather than using other reporting schemes (e.g., 1+/2+/3+, small/medium/large).

Table 1. Urinalysis result reporting for Connect Care

Test component	Siemens Clinitek Status	Manual Dipstick Urinalysis	Connect Care (EPIC) Result Reporting
	Device result reporting	Test strip vial reporting	
Color		Colorless	Colorless
	Yellow	Yellow	Yellow
	Amber	Amber	Amber
	Orange	Orange	Orange
	Red	Red	Red
	Brown	Brown	Brown
		Black	Black
	Other	Other	Other
Clarity	Clear	Clear	Clear
	Slightly Cloudy	Slightly Cloudy	Slightly Cloudy
	Cloudy	Cloudy	Cloudy
	Turbid	Turbid	Turbid
	Other (do not use)		
SG (Specific Gravity)	≤1.005	1.000	<1.005
		1.005	1.005
	1.010	1.010	1.010
	1.015	1.015	1.015
	1.020	1.020	1.020
	1.025	1.025	1.025
		1.030	1.030
	≥1.030		≥1.030
	Unable to interpret due to interfering substance	Unable to interpret due to interfering substance	Unable to interpret due to interfering substance
pH	5.0	5.0	5.0
	5.5		5.5
	6.0	6.0	6.0
	6.5	6.5	6.5
	7.0	7.0	7.0
	7.5	7.5	7.5
	8.0	8.0	8.0
	8.5	8.5	8.5
	≥9.0		≥9.0
LEU (Leukocytes) Leu/µL	Negative	Negative	Negative
	Ca 15	Trace (15)	15
	Ca 70	Small (+) (70)	70
	Ca 125	Moderate (++) (125)	125
	Ca 500	Large (+++) (500)	500
NIT (Nitrite)	Negative	Negative	Negative
	Positive	Positive	Positive
PRO (Protein)	Negative	Negative	Negative
	Trace	Trace	Trace
	0.3	0.3	0.3

Test component	Siemens Clinitek Status	Manual Dipstick Urinalysis	Connect Care (EPIC) Result Reporting
	Device result reporting	Test strip vial reporting	
	1.0	1.0	1.0
	≥3.0	3.0	≥3.0
		≥20	≥3.0
GLU (Glucose) mmol/L	Negative	Negative	Negative
	5.5	5.5	5.5
	14	14	14
	28	28	28
	≥55	55	≥55
		≥111	≥55
KET (Ketone) mmol/L	Negative	Negative	Negative
	Trace		Trace
		0.5	0.5
	1.5	1.5	1.5
	3.9	4.0	3.9
	7.8		≥7.8
		8.0	≥7.8
	≥15.6		≥7.8
		16.0	≥7.8
ERY (Erythrocytes) Ery/µL	Negative	Negative	Negative
	Trace-Lysed	Non Hemolyzed Trace	Trace
		Non Hemolyzed Moderate	Trace
	Trace-Intact	Hemolyzed Trace	Trace
	Ca 25	Small (+) (25)	25
	Ca 80	Moderate (++) (80)	80
	Ca 200	Large (+++) (200)	200

d) Blood Gas Tests

The following reference intervals and critical values were standardized for the province in preparation for Connect Care Implementation through Clinical Knowledge and Content Management (CKCM; Blood Gas Standardization of Reference Intervals & Critical Values). The Working Group assigned to this was created in consultation with the Critical Care Strategic Clinical Network, the Provincial Respiratory Professional Practice Council, and Laboratory Point of Care Testing Network, with additional experts consulted as required.

Arterial

Analyte	Reference Interval	Units	Critical Values	
pH	7.35 – 7.45	None	< 7.20	> 7.60
pCO2	35 – 45	mmHg	<20	>70
pO2	70 – 90	mmHg	<56	None
Bicarbonate (HCO3)	20 – 27	mmol/L	< 10	> 40
Total CO2	Not Reported	-	-	-
Base Excess	-4 to 1	mmol/L	None	None
Oxygen Saturation	90 – 100	%	None	None
Oxyhemoglobin	92 – 98	%	None	None
Carboxyhemoglobin	0.0 – 3.0	%	None	>15

Methemoglobin	0.0 – 1.5	%	None	>10
Deoxyhemoglobin	Not Reported	-	-	-
AaDO2	<15 Room Air <100 100%O2	mmHg	None	None

Venous

Analyte	Reference Interval	Units	Critical Values	
pH	7.30 – 7.40	None	< 7.15	> 7.55
pCO2	35 – 50	mmHg	< 15	>55 if pH < 7.2
pO2	30 – 50	mmHg	None	None
HCO3	20 –27	mmol/L	< 10	>40
Total CO2	Not Reported	-	-	-
Base Excess	-4 to 1	mmol/L	None	None
Oxygen Saturation	50 – 80	%	None	None
Oxyhemoglobin	50 – 80	%	None	None
Carboxyhemoglobin	0.0 – 3.0	%	None	>15%
Methemoglobin	0.0 – 1.5	%	None	>10%
Deoxyhemoglobin	Not Reported	-	-	-

Capillary Blood Gas

Analyte	Reference Interval	Units	Critical Values	
pH	7.32 – 7.42	None	< 7.20	> 7.50
pCO2	35 – 45	mmHg	< 25	> 70
pO2	None	mmHg	None	None
HCO3	20 – 27	mmol/L	<10	>40
Total CO2	Not Reported	-	-	-
Base Excess	-6 to 1	mmol/L	None	None
Oxygen Saturation	90 – 100	%	None	None
Oxyhemoglobin	85 – 95	%	None	None
Carboxyhemoglobin	0.0 – 3.0	%	None	>15%
Methemoglobin	0.0 – 2.0	%	None	>10%
Deoxyhemoglobin	Not Reported	-	-	-

Mixed Venous

Analyte	Reference Interval	Units	Critical Values	
pH	7.30 – 7.40	None	None	None
pCO2	35 – 50	mmHg	None	None
pO2	None	mmHg	None	None
HCO3	None	mmol/L	None	None
Total CO2	Not Reported	-	-	-
Base Excess	None	mmol/L	None	None
Oxygen Saturation	None	%	None	None
Oxyhemoglobin	None	%	None	None
Carboxyhemoglobin	0.0 – 3.0	%	None	>15
Methemoglobin	0.0 – 1.5	%	None	>10
Deoxyhemoglobin	Not Reported	-	-	-

Central Venous

Analyte	Reference Interval	Units	Critical Values	
pH	7.30 – 7.40	None	None	None
pCO2	35 – 45	mmHg	None	None
pO2	None	mmHg	None	None
HCO3	None	mmol/L	None	None
Total CO2	Not Reported	-	-	-
Base Excess	None	mmol/L	None	None
Oxygen Saturation	None	%	None	None
Oxyhemoglobin	None	%	None	None
Carboxyhemoglobin	0.0 – 3.0	%	None	>15
Methemoglobin	0.0 – 1.5	%	None	>10
Deoxyhemoglobin	Not Reported	-	-	-

ECMO

Analyte	Reference Interval	Units	Critical Values	
pH	7.30 – 7.45	None	None	None
pCO2	35 – 50	mmHg	None	None
pO2	None	mmHg	None	None
HCO3	None	mmol/L	None	None
Total CO2	Not Reported	-	-	-
Base Excess	None	mmol/L	None	None
Oxygen Saturation	None	%	None	None
Oxyhemoglobin	None	%	None	None
Carboxyhemoglobin	None	%	None	None
Methemoglobin	None	%	None	None
Deoxyhemoglobin	Not Reported	-	-	-

Cord Blood Gas - Arterial

Analyte	Reference Interval	Units	Critical Values	
pH	7.2 – 7.4	None	<7.15	None
pCO2	35 – 70	mmHg	None	None
pO2	Not Reported	mmHg	-	-
HCO3	17 – 27	mmol/L	None	None
Total CO2	Not Reported	-	-	-
Base Excess	-9 to +2	mmol/L	< -10	None
Oxygen Saturation	Not Reported	-	-	-

Cord Blood Gas - Venous

Analyte	Reference Interval	Units	Critical Values	
pH	7.25 – 7.45	None	<7.15	None
pCO2	30 – 55	mmHg	None	None
pO2	Not Reported	mmHg	-	-
HCO3	16 – 25	mmol/L	None	None
tCO2	Not Reported	-	-	-
Base Excess	-10 to 0	mmol/L	< -10	None
Oxygen Saturation	Not Reported	-	-	-

pH Fluid

Analyte	Reference Interval	Units	Critical Values	
pH	>=7.20	None	None	None

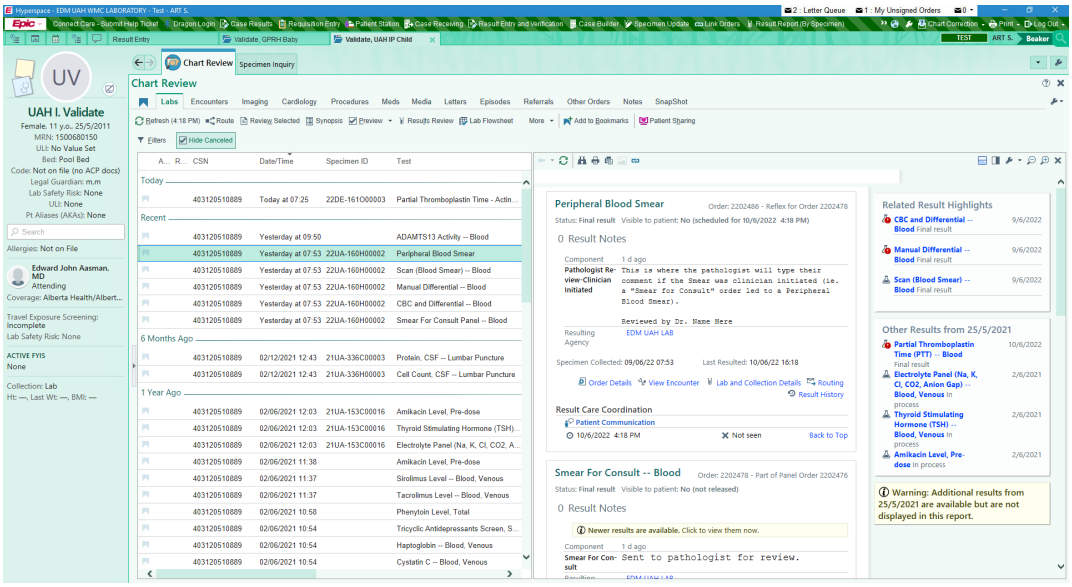
D. Hematology , Coagulation and Flow Cytometry

I. Hematology and Coagulation Reference Range changes

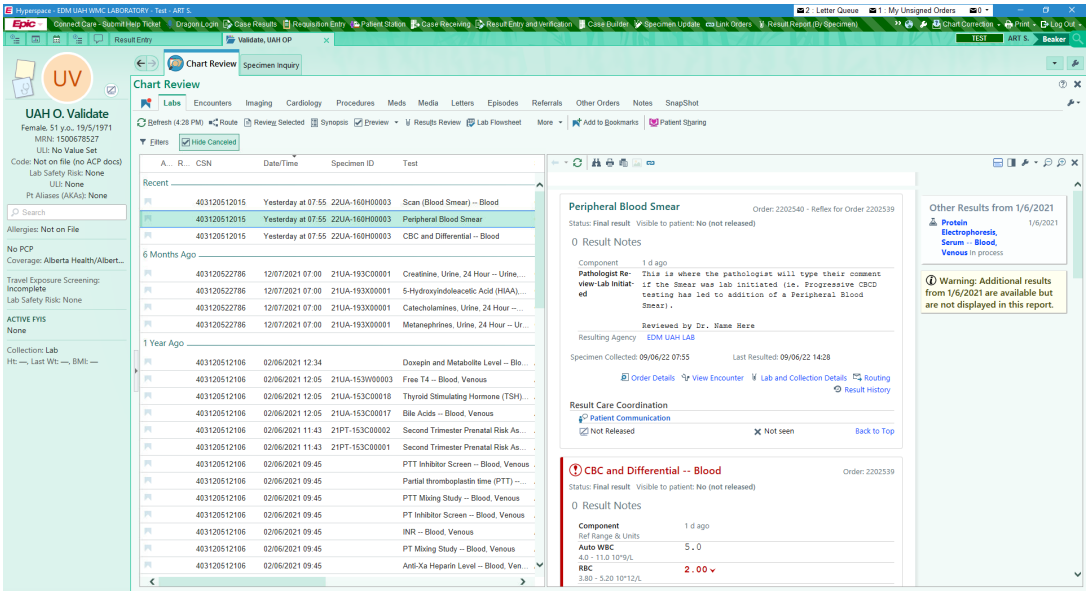
October 2022
Appendix A Major C

II. Blood Smears

- "Smear for Consult" – these are Clinician orderable tests requesting pathologist review.
    - Initially a technologist may review the slide. If there is nothing abnormal seen, no (or minimal) numeric abnormalities, and no abnormal analyzer flags then the Smear for Consult will not be further reviewed by a pathologist. If there is a reason that requires a pathologist specifically, please contact the lab within 7 days to provide that reason.
    - If the initial technologist review does reveal findings of potential clinical significance, then a "Peripheral Blood Smear" will be added-on, which a pathologist will result.
- "Peripheral Blood Smear" – these are pathologist resulted tests. They may arise in one of two ways:
    - If a "Smear for Consult" is ordered by a clinician and passes initial review by a technologist (as described above). Note that under this circumstance one can tell that a Clinician had requested this testing directly because the report indicates: "Pathologist Review-Clinician Initiated"



- The other reason a "Peripheral Blood Smear" may be resulted is when specific abnormalities are identified on a CBC/D that trigger a pathologist review. In this circumstance the clinician did not initially request the "Peripheral Blood Smear" but instead it was added-on as a reflex test per laboratory protocol, as part of progressive testing. If the pathologist sees something that may be of additional clinical significance (beyond what is reported on the CBCD, Manual Differential and Scan) they will document their impression; if something critical is found then the clinician ordering the CBC/D will be contacted directly. Otherwise, the pathologist will just include a note indicating that they have reviewed the smear. Note that under this circumstance one can tell that the "Peripheral Blood Smear" originated because of lab protocol (instead of a direct Clinician order) because the report indicates: "Pathologist Review-Lab Initiated":



III. Bone Marrows

- For clinicians performing a bone marrow aspiration and/or trephine biposy:

- Recommend ordering a "Bone Marrow Panel (Proc Panel)" in Epic. This automatically orders a Panel of tests which includes a:
    - Bone Marrow Cell Differential
    - Bone Marrow Exam
    - Leukemia/Lymphoma Immunophenotyping
    - Cytogenetic Analysis
    - HOLD DNA FOR MOLECULAR PATHOLOGY
    - HOND RNA FOR MOLECULAR PATHOLOGY
- In addition, a CBCD and Reticulocyte count should be collected within 24 hours (before or after) bone marrow collection. If this has not been completed at the time of marrow procurement, then the clinician has the option to include orders for CBCD and Reticulocyte Count when ordering the Bone Marrow Panel; note that these are not included by default.
- A Bone Marrow Panel does not include the following which must be ordered individually if/when needed (indicate Specimen Src: Bone Marrow Aspirate when ordering):
    - Bone Marrow Culture
    - Mycobacteria Culture
    - Fungal Culture
    - Viruses – must order each specific type of test needed individually
        - If uncertain of what testing to order, please page/call the Virologist On-Call to discuss.

- Bone Marrow results in Netcare:

- All bone marrow reports generated in Connect Care will now appear in the Pathology folder in Netcare.

IV. PTT and Heparin Nomogram

With the standardization requirement in both pharmacy and lab, it was a challenge to create a single heparin nomogram that would work with the different reference ranges generated by the various reagent / analyzer combination. The document in the link below describes how this has been accomplished.

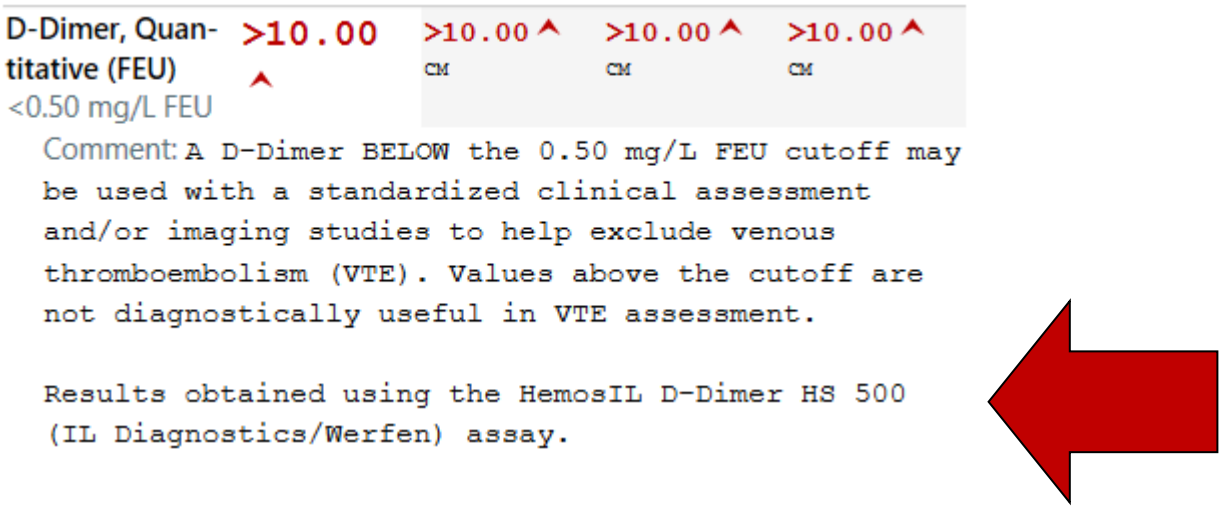
https://insite.albertahealthservices.ca/Main/assets/cis/tms-cis-provincially-standardized-ptt-comments.pdf

V. D-Dimer

- Across Alberta, there are a variety of different D-Dimer methods in use due to differing analyzers, patient volumes, and historic commercial contracts.
    - Each method has a single manufacturer-determined clinical cutoff for Venous Thromboembolism (VTE) exclusion, which undergoes a limited verification by the lab prior to test implementation.
    - APL does not have the ability to perform the outcomes studies required to validate alternative cutoffs.
    - Similar performance between assay methods cannot be guaranteed due to lack of an international D-Dimer reference standard.

        - Some assays are well-studied in the age-adjusted cutoff literature, while evidence for others may be limited or non-existent.
        - Most widely available age-adjustment calculators online do not account for differences between assay types/manufacturers.
        - Even assays with the same VTE cut-off (e.g. 0.50 mg/L FEU) may show very different reactivity at values other than this cut-off.
- The assay method is included as a result comment at ConnectCare sites (see example below).
- When considering whether to apply alternative cutoffs, providers are advised to verify the method used for each patient (do not assume the testing was performed at your local lab), and to be familiar with the evidence for the method.

Example of D-Dimer Method information in ConnectCare:



VI. Flow cytometry

- The B, T, and NK Enumeration test is no longer available in the North Sector.
    - Instead T-cell Subsets, or B Cell Enumeration can be ordered separately.
    - NK cell enumeration is not routinely available but can be obtained as part of an Immunodeficiency Screening Panel for testing in Calgary.

- Leukemia/Lymphoma Immunophenotyping (by Flow Cytometry)
    - Clinicians are required to answer a hard stop question to specify the clinical indication.
    - This will allow the laboratory to determine which antibody panels are needed for analysis.
        - Please note: “Pancytopenia (Bone Marrow ONLY)” can only be performed on bone marrow and will be auto-cancelled if requested on peripheral blood in North Sector.

- Hereditary Spherocytosis
    - “Hereditary Spherocytosis by Flow Cytometry” is adequate for diagnosis of Hereditary Spherocytosis in the vast majority of individuals and can be ordered directly in Epic.

- In Edmonton only, “Hereditary Spherocytosis by Flow Cytometry and Osmotic Fragility” may be needed in some select cases and requires booking for collection through Client Response (780-407-7484).

VII. Body Fluid Crystals

- Assessing for joint fluid crystals:
  - Order “Body Fluid Crystals”
  - Specify Specimen Type as “Synovial Fluid”
  - Specify the joint aspirated under Specimen Source (eg. “Knee, Left”)
- Assessing any other aspirate type (ie. other than joint fluid) for monosodium urate crystals:
  - Order “Body Fluid Crystals”
  - Specify “Other” under Specimen Type
  - Specify the anatomic site (where the aspirate was collected) under Specimen Source.
- Bile fluid assessment for Cholesterol crystals is not an orderable test.

E. Transfusion Medicine

There are several resources available pertaining to transfusion medicine in the Connect Care Knowledge Library and the Learning Home Dashboard. The most comprehensive resource for EPIC / WellSky information is called the Blood Administration Manual. It can be found by searching: Blood administration guide | Insite (albertahealthservices.ca) There are also 6 modules within My Learning Link dedicated to different aspects of Blood Administration. More generic transfusion medicine resources continue to be available on Insite and AHS websites (https://insite.albertahealthservices.ca/lab/Page7421.aspx and https://www.albertahealthservices.ca/lab/Page3318.aspx).

Transfusion Prenatal testing should continue to be ordered on the Canadian Blood Services requisition. Work is underway to build a reference laboratory interface to allow results to flow back to the Connect Care chart. For Rh negative prenatal and postpartum patients, please ensure ordering of Prenatal and Postnatal Evaluation to ensure that eligibility for Rh Immune Globulin can be assessed.

For patients who are admitted under an alias name and have Type and Screen testing performed using that alias, do not remove the alias arm band or the TSIN band until the Type and Screen expires or is recollected. Since transfusion of red cells, platelets, plasma and cryoprecipitate requires administration within an approved facility, pre-transfusion testing and blood component requests will be restricted to physicians who have privileges within those environments.

It is very important to ensure that the orders for transfusion are placed in the correct facility and encounter for where the actual transfusion is to occur to avoid loss of orders or components being sent to the incorrect location. It is also important to note that since the transfusion medicine laboratories are seen as a separate facility to the site laboratory, it is not possible to do “add-ons” within the EPIC system.

Since transfusion of Red cells, platelets, plasma and cryoprecipitate requires administration within an AHS or Covenant facility, pretransfusion testing and component requests will be restricted to physicians who have privileges within those environments.

F. Anatomic Pathology

Preliminary results
In EPIC and in some of the downstream electronic applications, preliminary reports will be overwritten by final reports on the patient chart once the final report is verified.

Biomarker results
Biomarker results will now be reported as addendum reports to the corresponding surgical specimen. These are available in NetCare by hovering the cursor over the surgical case specimen and a "corrected" text box will signal that the biomarker report is available.

Cytology
Cytology specimens will have a new maximum of 5 parts per case. Cases are produced by encounter, and cases with more than 5 parts will be issued additional report(s).