

MATERNAL/FETAL NEONATAL AND PEDIATRICS:

TIERS OF LABORATORY
MEDICINE,
PATHOLOGY &
TRANSFUSION
MEDICINE SERVICES

TIERS IN BRIEF
TIERS IN FULL

APRIL 2018

Maternal/Fetal, Neonatal and Pediatrics: Tiers of Laboratory Medicine, Pathology & Transfusion Medicine Services

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Maternal/Fetal, Neonatal and Pediatrics: Tiers of Laboratory Medicine, Pathology & Transfusion Medicine Services

1.0 Introduction to the Maternal/Fetal, Neonatal and Pediatric Services Planning Framework

The Maternal/Fetal, Neonatal and Pediatric Services Planning Framework is made up of a series of Tiers of Service modules. These modules:

- Provide a common language to streamline planning, coordination and integration of maternal/fetal, neonatal and pediatric health services across sectors and geographic boundaries.
- Provide a framework to align clinical and clinical diagnostic services according to tier defined needs. Tiers help to match need and capacity.
- Facilitate a common appreciation of the responsibilities and relative capabilities of each type and level of service, including academic roles and educational opportunities.
- Support the availability of appropriate resources to fulfill those responsibilities.

The modules include:

Clinical Services modules:

- Children's Medicine
- Children's Surgery
- Children's Emergency Department
- Children's Critical Care
- Child Development, Habilitation & Rehabilitation
- Children's Home-based Services
- Children's Mental Health
- Children's Substance Use
- Maternal/Fetal Services
- Newborn Services

Clinical Diagnostic & Therapeutic Service modules:

- Maternal/Fetal, Neonatal and Pediatrics:
Laboratory Medicine, Pathology &
Transfusion Medicine
- Children's Medical Imaging
- Children's Pharmacy Services

Collectively, the modules and their components provide the foundation for provincial and health authority (HA) planning of child health services.

2.0 Purpose of this Document

This document - Maternal/Fetal, Neonatal and Pediatrics: **Laboratory Medicine, Pathology & Transfusion Medicine Services** - describes the services provided by hospital-based BC laboratories to support the clinical care of maternal women, neonates and children in BC.

3.0 Process Used to Develop Document

This document was developed by an interdisciplinary working group comprised of laboratory physicians, clinical scientists and operational leaders from each of BC's HAs, a pediatrician, representatives from Child Health BC and Maternal Services BC and a meeting facilitator. The document was informed by work done in other jurisdictions, mostly notably Queensland¹ and New South Wales.² B.C. data was used where it was available, as were relevant BC, Canadian and international standards and guidelines (e.g., Diagnostic Accreditation Program Standards,³ Accreditation Canada standards,⁴ Canadian Blood Services Clinical Guide to Transfusion Medicine,⁵ Royal College of Obstetricians and Gynaecologists & Royal College of Pathologists⁶) and relevant literature.⁷⁻¹⁴

In addition to the working group, the following groups were invited to provide feedback on the draft document:

- Ad hoc provincial group with responsibility for blood collection
- Several committees of BC's Agency for Pathology and Laboratory Medicine (Agency):
 - Technical Resource Group
 - Transfusion Medical Advisory Group
 - Quality Working Group
 - Discipline Working Groups (hematology, chemistry, etc)

The final version of the module was submitted to BC's Agency for Pathology and Laboratory Medicine Regional Leadership Committee, the Child Health BC Steering Committee and the Perinatal Services BC Steering Committee for their acceptance.

Following completion of the document, the next steps will be:

- Self-assessment by each HA of their laboratory tier alignment and their ability to meet the responsibilities and requirements at that tier.
- Development of HA and provincial "current state" summaries of laboratory services including identification of strengths and opportunities for improvement.
- Creation of a provincial plan for maternal/fetal, neonatal and pediatric laboratory services that is in alignment with plans for maternal/fetal, neonatal and pediatric clinical services.
- Ongoing utilization of the tool for service planning and quality improvement at HA and provincial levels.

4.0 Scope of Document

Laboratory services included in this module are hospital-based and accessible as follows to:

- a. Maternal women.
- b. Neonates.
- c. Children:¹⁵
 - o New patients: Up to a child's 17th birthday (16 years + 364 days); and
 - o Children receiving ongoing care: Up to a child's 19th birthday (18 years + 364 days).

Laboratory Services *not discussed* in this module include:

- Laboratory services provided to adults other than maternal women.
- Laboratory services provided in private laboratories (beyond the influence of the tiers of service initiative).

Note re standalone hospital and non-hospital-based outpatient laboratory collection sites:

- The expectations for these sites are the same as for those described in the "specimen collection service" section under Tier A in the attached document.
- Oversight for these standalone outpatient laboratory collection sites are provided by an off-site pathologist(s). The sites are usually staffed by a medical laboratory assistant(s).

5.0 Tiers of Service: Laboratory Medicine, Pathology & Transfusion Medicine

5.1 Tiers in Brief

There are 6 tiers in the *clinical diagnostic* tiers of service for Laboratory Medicine, Pathology & Transfusion Medicine services:

- *General* maternal/pediatric laboratory services: Tiers A, B, C & D.
- *Specialty and Subspecialty* maternal/pediatric laboratory services: Tiers E & F.

Table 1 provides an overview (Tiers in Brief) of the Laboratory Medicine, Pathology & Transfusion Medicine Tiers of Service.

The intention of the tiers of service is to align laboratory, pathology and transfusion medicine services with the clinical needs of a majority of patients who access the site. A patient requiring laboratory services does not usually need to be near the facility that is processing the laboratory test. There are some time-sensitive tests, however, that require the patient to be nearby. Where there is infrequent acute activity, a non-urgent sample can be collected and sent off-site for processing and the report returned. If urgent, the patient may require transfer to a facility with access to a higher tier laboratory service. Trauma, emergency, oncology and maternity volumes are key variables in the level of pathology service required, due to the frequency of requests.

Table 1: Tiers in Brief: Maternal, Neonatal & Pediatric - Laboratory Medicine, Pathology & Transfusion Medicine

	Prevention, Primary & Emergent Lab Services	General Lab Services	Maternal, Neonatal &/or Pediatric-Focused Lab Services	Maternal, Neonatal &/or Pediatric Comprehensive Lab Services	Maternal, Neonatal &/or Pediatric Regional Subspecialty Lab Services	Maternal, Neonatal &/or Pediatric Provincial Subspecialty Lab Services
	Tier A	Tier B	Tier C	Tier D	Tier E	Tier F
Service reach	Local community.	Local community/ local health area.	Multiple local health areas/health service delivery area.	Health service delivery area/ health authority.	Health authority.	Province.
Service focus	Laboratory/ pathology services which support the care of low-risk maternal women & healthy infants & children. Service available in primary care/community health centres. Refers testing to Tier B-F as necessary.	Laboratory/ pathology services which support the care of maternal women, infants & children with low acuity / complexity conditions. Service available in small community hospitals. Refers testing to Tier C-F as necessary.	Laboratory/pathology services which support the care of maternal women, infants & children with relatively common, medium acuity / complexity conditions. Service available in mid-sized community hospitals with on-call pediatric coverage 24/7. Refers testing to Tier D-F as necessary.	Laboratory/pathology services which support the care of maternal women, infants & children with a broad range of medium acuity / complexity conditions. Service available in large-sized community hospitals with on-call pediatric coverage 24/7. Refers testing to Tier E-F as necessary.	Laboratory/pathology services which support the care of maternal women, infants & children with high acuity / complexity conditions. The range of conditions is dependent upon the types of subspecialists available on-site. Service available in regional referral hospitals with on-call pediatric coverage 24/7. Refers testing to Tier F as necessary.	Laboratory/pathology services which support the care of maternal women, infants & children with the most acute/complex conditions. Service available in provincial referral hospital with on-call pediatric subspecialty coverage 24/7, including maternity & pediatric laboratory/pathology subspecialists.
Brief overview of services	Maternal/fetal, neonatal & pediatric lab collections. Very limited, if any, on-site lab testing other than point of care testing (POCT).	Maternal/fetal, neonatal & pediatric lab collections. Urgent laboratory testing & resulting on-site. Limited inventory of plasma protein products & components stored on-site for emergency use (e.g., Group O RBCs, AB plasma).	Same as Tier B plus: Routine lab testing, resulting & interpretation on-site. No on-site pathologist interpretation available. Standard plasma protein products & blood components stored on-site (most RBC groups, plasma, albumin, RhIG).	Same as Tier C plus: Routine & some specialty lab testing, resulting, interpretation & consultation on-site. On-site pathologist interpretation available. Some specialized plasma products & blood components stored on-site.	Same as Tier D plus: Routine & some specialty lab testing, resulting, interpretation & consultation on-site (broader range of testing than at Tier D). Broader range of specialized plasma products & blood components stored on site (e.g., Factor VIII & prothrombin concentrates).	Same as Tier E plus: Routine & specialty maternal/fetal, neonatal & pediatric laboratory & pathology testing, resulting, interpretation & consultation on-site. Oversees the newborn & perinatal screening laboratories. Routine & specialty maternal/fetal, neonatal & pediatric transfusion medicine services available on-site including intrauterine and pediatric exchange transfusions. Performs testing & provides consultation to provincial pediatric hematology, oncology & transplant programs.

	Prevention, Primary & Emergent Lab Services	General Lab Services	Maternal, Neonatal &/or Pediatric-Focused Lab Services	Maternal, Neonatal &/or Pediatric Comprehensive Lab Services	Maternal, Neonatal &/or Pediatric Regional Subspecialty Lab Services	Maternal, Neonatal &/or Pediatric Provincial Subspecialty Lab Services
	Tier A	Tier B	Tier C	Tier D	Tier E	Tier F
Brief overview of services cont'd				<p>(e.g., platelets, cryoprecipitate/fibrinogen, factor replacement, immune globulins).</p> <p>Pools & aliquots blood components for routine, non-emergency transfusions on days, M-F.</p>	<p>Pools & aliquots &/or plasma reduces blood components & prepares components for routine, non-emergency & emergency transfusions 24/7.</p> <p>Reconstitutes whole blood for neonatal exchange transfusions.</p>	<p>Provides professional laboratory consultation & expertise to (1) provincially delivered programs based at C&W; & (2) health care providers throughout the province in high acuity maternal/fetal, neonatal & pediatric care.</p> <p>Provincial resource for validated methods/guidelines & instrumentation to accommodate requirements for small volume testing.</p> <p>Develops, maintains & disseminates provincial guidelines, algorithms & tools supportive of maternal, neonatal & pediatric laboratory testing.</p> <p>Provides leadership & works collaboratively with HAs to establish provincial (1) maternal/fetal, neonatal & pediatric reference ranges & critical values; and (2) maximum and, where appropriate, minimum neonatal & pediatric blood sample collection volumes.</p> <p>In collaboration with researchers, HAs & colleagues in other Tiers, leads pilot projects assessing clinical utility of emerging diagnostic & screening technologies in maternal/fetal, neonatal, & pediatric laboratory medicine. Establishes standards of care for the province in these areas.</p> <p>Actively participates in national & international networks for maternal/fetal, neonatal & pediatric laboratory, pathology & transfusion medicine. Promotes adoption of best practices in BC.</p>

5.2 Tiers in Full

5.2.1 Clinical Diagnostic Services

The next section describes the responsibilities and requirements at each tier to provide a **safe, sustainable** and **appropriate** level of maternal/fetal, neonatal and pediatric laboratory, pathology and transfusion medicine services (i.e., not necessarily current state but not "pie in the sky").

The section is divided into:

- 5.2.1.1 Responsibilities:
 1. Specimen collection
 2. Tests standards and methods
 3. Availability of tests and results
 4. Availability of plasma protein products and fresh blood components
 5. Provincial consultation

- 5.2.1.2 Requirements
 1. Personnel (professional and technical)
 2. Regulations

Responsibilities related to (1) Knowledge Sharing & Transfer/Training and (2) Quality Improvement & Research are described in subsequent sections of this document (sections 5.3 and 5.4).

5.2.1.1 Responsibilities

	Prevention, Primary & Emergent Lab Services	General Lab Services	Maternal, Neonatal &/or Pediatric-Focused Lab Services	Maternal, Neonatal &/or Pediatric Comprehensive Lab Services	Maternal, Neonatal &/or Pediatric Regional Subspecialty Lab Services	Maternal, Neonatal &/or Pediatric Provincial Subspecialty Lab Services
	Tier A	Tier B	Tier C	Tier D	Tier E	Tier F
1. Specimen collection						
a. Types of collections	<p>Collects maternal, neonatal & pediatric laboratory specimens.</p> <p>At a minimum, blood samples include:</p> <ul style="list-style-type: none"> • Adults: Venipuncture • Children: <ul style="list-style-type: none"> • Heel pokes (<1 yr old) • Finger pokes (>1 yr old) • Access to pediatric venipuncture <p>Procedure in place for pediatric urine collection.</p>	<p>Collects maternal, neonatal & pediatric laboratory specimens.</p> <p>At a minimum, blood samples include:</p> <ul style="list-style-type: none"> • Adults: Venipuncture • Children: <ul style="list-style-type: none"> • Heel pokes (<1 yr old) • Finger pokes (>1 yr old) <p>Performs pediatric venipuncture using winged set needle with vacutainer holder &/or syringe.^{1,2}</p> <p>Procedure in place for pediatric urine collection.</p>	Same as Tier B.	<p>Same as Tier C plus:</p> <p>Performs pediatric venipuncture using:</p> <ul style="list-style-type: none"> • Straight needle with vacutainer holder. • Winged set needle with vacutainer holder; and • Winged set needle with syringe. <p>If sweat testing is performed, collection follows the Cystic Fibrosis Foundation guidelines: www.cff.org/Diagnostic-Sweat-Testing-CFF-Guidelines-J-Pediatrics-2007.pdf.</p>	Same as Tier D.	Same as Tier E.

¹ Wing set needle is preferred to a straight needle in the following circumstances: (1) child <5 years old; (2) child <10 yrs old and is anxious or needle phobic; and/or (3) multiple tubes of blood are required.

² Vacutainer is preferred if the veins have good integrity. Syringe is preferred for neonates or children with small or scarred veins.

	Prevention, Primary & Emergent Lab Services	General Lab Services	Maternal, Neonatal &/or Pediatric-Focused Lab Services	Maternal, Neonatal &/or Pediatric Comprehensive Lab Services	Maternal, Neonatal &/or Pediatric Regional Subspecialty Lab Services	Maternal, Neonatal &/or Pediatric Provincial Subspecialty Lab Services
	Tier A	Tier B	Tier C	Tier D	Tier E	Tier F
b. Written procedures	<p>Written procedures are in place to guide:</p> <ul style="list-style-type: none"> • Selection of appropriate specimen collection type (skin puncture vs venipuncture). • Mother-baby togetherness during blood collection to minimize procedural pain (e.g., promote skin-to-skin &/or active breastfeeding) (see Appendix 1 for specifics). • Actions if two blood collection attempts are unsuccessful. 	<p>Same as Tier A plus:</p> <p>Written procedures are in place to guide:</p> <ul style="list-style-type: none"> • Selection of appropriate type of collection device/ equipment. • Maximum and, where appropriate, minimum blood collection volumes for single collections (based on provincial recommendations developed by Tier F in collaboration with other tiers). • Actions when the orders from the ordering provider will result in a blood volume which exceeds the recommended maximum volume. 	Same as Tier B.	Same as Tier C.	Same as Tier D.	<p>Same as Tier E plus:</p> <p>Provides leadership & works collaboratively with HAs to establish provincial maximum and, where appropriate, minimum blood sample collection volumes for single collections in children aged 0 to 14 yrs.</p>

	Prevention, Primary & Emergent Lab Services	General Lab Services	Maternal, Neonatal &/or Pediatric-Focused Lab Services	Maternal, Neonatal &/or Pediatric Comprehensive Lab Services	Maternal, Neonatal &/or Pediatric Regional Subspecialty Lab Services	Maternal, Neonatal &/or Pediatric Provincial Subspecialty Lab Services
	Tier A	Tier B	Tier C	Tier D	Tier E	Tier F
c. Care plans for children with complex needs				<p>Develops individual care plans for specimen collection on neonates & children with complex/high needs to minimize numbers of collections & associated trauma.</p> <p>Consults with Child Life Specialist &/or relevant health care providers & the child/family in development of plans.</p> <p>Documents & maintains processes to ensure staff are aware of plans.</p> <p>Medical laboratory assistant (MLA(s)) identified as having additional expertise in collecting blood specimens from neonates & children with complex/high needs. MLA is a resource to other MLAs. Expertise is acquired & maintained through regular exposure & pediatric-focused continuing education (e.g., inservices).</p>	<p>Same as Tier D plus:</p> <p>Child life specialist &/or psychologist available to support children/families with complex/high needs during pre-scheduled blood collection procedures on days, M-F as per care plan, if required.</p>	<p>Same as Tier E plus:</p> <p>Provincial resource for specimen collection on neonates & children with complex/high needs (e.g., development of care plans, mother-baby togetherness strategies, specimen collection procedures).</p>

	Prevention, Primary & Emergent Lab Services	General Lab Services	Maternal, Neonatal &/or Pediatric-Focused Lab Services	Maternal, Neonatal &/or Pediatric Comprehensive Lab Services	Maternal, Neonatal &/or Pediatric Regional Subspecialty Lab Services	Maternal, Neonatal &/or Pediatric Provincial Subspecialty Lab Services
	Tier A	Tier B	Tier C	Tier D	Tier E	Tier F
d. Staff orientation	<p>Orientation for new staff includes teaching re:</p> <ul style="list-style-type: none"> • How to collect neonatal & pediatric specimens, including blood samples (heel & finger pokes). • Potential psycho/emotional impact of specimen collection on children (short and long-term impact). • Techniques for non-pharmacologic management of procedural pain in children. 	<p>Same as Tier A plus:</p> <p>Orientation for new staff includes teaching re:</p> <ul style="list-style-type: none"> • How to collect venipuncture samples on neonates & children, including selection of the appropriate type of collection device/ equipment. 	Same as Tier B.	Same as Tier C.	Same as Tier D.	Same as Tier E.
e. Maintaining staff competencies	<p>Processes are in place to ensure staff is competent in the collection of neonatal & pediatric specimens.</p> <p>Competencies for capillary heel & finger pokes are assessed following orientation & annually thereafter (see Appendix 2 for a sample competency checklist for micro collections). The assessment is utilized to develop a learning plan to address knowledge/skill deficits & manage situations where volumes are insufficient to maintain competence (e.g., organize opportunity for staff to spend time at a higher volume neonatal/ pediatric site).</p>	<p>Same as Tier A plus:</p> <p>Competencies for collecting venipuncture samples on neonates and children are assessed following orientation & annually thereafter (see Appendix 2 for sample competency checklists for micro & venipuncture collections).</p>	Same as Tier B.	Same as Tier C.	Same as Tier D.	<p>Same as Tier E plus:</p> <p>Organizes/develops province-wide learning activities that support the maintenance of staff competencies in maternal, neonatal & pediatric specimen collection processes. e.g., provincial rounds, education sessions, self-learning modules.</p>

	Prevention, Primary & Emergent Lab Services	General Lab Services	Maternal, Neonatal &/or Pediatric-Focused Lab Services	Maternal, Neonatal &/or Pediatric Comprehensive Lab Services	Maternal, Neonatal &/or Pediatric Regional Subspecialty Lab Services	Maternal, Neonatal &/or Pediatric Provincial Subspecialty Lab Services
	Tier A	Tier B	Tier C	Tier D	Tier E	Tier F
2. Test standards & methods						
a. Point of care testing (POCT)	<p>POCT meets DAP requirements,¹⁶ including processes to:</p> <ul style="list-style-type: none"> • Receive requests & make recommendations on the scope of POCT appropriate for maternal, neonatal & pediatric populations. • Provide theoretical & practical training to staff performing POCT on maternal, neonatal & pediatric populations. • Use validated POCT. Regularly verify, monitor & document the results of POCT performed on maternal, neonatal & pediatric populations for each POCT instrument on-site. • Follow-up of results that fall outside of the reportable range for POCT equipment or do not correlate with the clinical presentation (e.g. repeat exam, collect repeat sample, refer sample to central or referral lab). 	Same as Tier A.	Same as Tier B.	Same as Tier C.	Same as Tier D.	Same as Tier E.

	Prevention, Primary & Emergent Lab Services	General Lab Services	Maternal, Neonatal &/or Pediatric-Focused Lab Services	Maternal, Neonatal &/or Pediatric Comprehensive Lab Services	Maternal, Neonatal &/or Pediatric Regional Subspecialty Lab Services	Maternal, Neonatal &/or Pediatric Provincial Subspecialty Lab Services
	Tier A	Tier B	Tier C	Tier D	Tier E	Tier F
b. Analytical methods	If on-site laboratory testing is performed other than point of care testing (POCT), expectations are the same as listed under Tier B.	Utilizes analytical methods which have been validated for maternal/fetal, neonatal & pediatric populations. e.g., validation of capillary specimens as a sample type; performance in the low range for certain analytes.	Same as Tier B.	Same as Tier C.	Same as Tier D.	Same as Tier E plus: Provincial resource for validated methods/guidelines and instrumentation to accommodate requirements for small volume testing.
b. Analytical practice standards	Practice is consistent with published standards, where available.	Same as Tier A.	Same as Tier B.	Practice is consistent with published standards, where available, & Tier F practice guidelines/ recommendations, where available. For example: <ul style="list-style-type: none"> Sweat testing (if performed): www.cff.org/Diagnostic-Sweat-Testing-CFF-Guidelines-J-Pediatrics-2007.pdf (current as of Jan 22, 2018). Prenatal diagnosis of fetal aneuploidies (if performed): www.jogc.com/article/S1701-2163(16)35022-8/pdf (current as of Jan 22, 2018). 	Same as Tier D.	Same as Tier E.

	Prevention, Primary & Emergent Lab Services	General Lab Services	Maternal, Neonatal &/or Pediatric-Focused Lab Services	Maternal, Neonatal &/or Pediatric Comprehensive Lab Services	Maternal, Neonatal &/or Pediatric Regional Subspecialty Lab Services	Maternal, Neonatal &/or Pediatric Provincial Subspecialty Lab Services
	Tier A	Tier B	Tier C	Tier D	Tier E	Tier F
d. Reference ranges	If on-site laboratory testing is performed other than point of care testing (POCT), expectations are the same as listed under Tier B.	Utilizes maternal/fetal, neonatal & pediatric reference ranges, where available. Utilizes provincial Tier F guidelines in the development of local maternal/fetal, neonatal & pediatric reference ranges.	Same as Tier B.	Same as Tier C.	Same as Tier D.	Same as Tier E plus: Provides leadership & works collaboratively with HAs to establish provincial guidelines for the development of maternal/fetal, neonatal & pediatric reference ranges.
e. Critical values	If on-site laboratory testing is performed other than point of care testing (POCT), expectations are the same as listed under Tier B.	Identifies critical values for maternal/fetal, neonatal & pediatric laboratory tests. Takes action on critical values as per HA/lab protocol. Utilizes provincial Tier F guidelines in the development of local maternal/fetal, neonatal & pediatric critical values.	Same as Tier B.	Same as Tier C.	Same as Tier D.	Same as Tier E plus: Provides leadership & works collaboratively with HAs to establish provincial guidelines for the development of maternal/fetal, neonatal & pediatric critical values. Focus is on tests in which the critical values &/or response times differ from the adult population.

	Prevention, Primary & Emergent Lab Services	General Lab Services	Maternal, Neonatal &/or Pediatric-Focused Lab Services	Maternal, Neonatal &/or Pediatric Comprehensive Lab Services	Maternal, Neonatal &/or Pediatric Regional Subspecialty Lab Services	Maternal, Neonatal &/or Pediatric Provincial Subspecialty Lab Services
	Tier A	Tier B	Tier C	Tier D	Tier E	Tier F
3. Availability of tests & results						
Hematology & Chemistry	<p><i>Point-of-care testing (POCT):</i></p> <ul style="list-style-type: none"> Point-of-care testing (POCT) available. Examples might include: pregnancy (BHCG), bilirubin, blood glucose & INR testing. <p><i>On-site testing:</i></p> <ul style="list-style-type: none"> Very limited, if any, on-site hematology & chemistry testing available other than POCT. <p><i>Non-urgent testing (on or off-site):</i></p> <ul style="list-style-type: none"> Non-urgent access to off-site hematology & chemistry testing. 	<p><i>POCT:</i></p> <ul style="list-style-type: none"> Same as Tier A. <p><i>On-site testing:</i></p> <ul style="list-style-type: none"> Urgent hematology & chemistry tests performed and resulted on-site. Results available on a stat, timed & routine basis 24/7. No on-site pathologist interpretation available. <p><i>Non-urgent testing (on or off-site):</i></p> <ul style="list-style-type: none"> Same as Tier A. <p>Minimum set of tests to be available on-site at Tier B laboratories will be developed collaboratively by Tier B and Tier F laboratories, Lab Agency & T2 clinical programs (this is a placeholder).</p>	<p><i>POCT:</i></p> <p>Same as Tier B.</p> <p><i>On-site testing:</i></p> <ul style="list-style-type: none"> Urgent & routine hematology & chemistry tests performed and resulted on-site. Results available on a stat, timed & routine basis 24/7. Range of tests is broader than at Tier B. <p><i>Non-urgent testing (on or off-site):</i></p> <ul style="list-style-type: none"> Same as Tier B 	<p><i>POCT:</i></p> <p>Same as Tier C.</p> <p><i>On-site testing:</i></p> <p>Same as Tier C plus:</p> <ul style="list-style-type: none"> Range of urgent & routine hematology & chemistry tests performed & resulted on-site is broader than at Tier C (e.g., on-site Kleihauer-Betke testing, interpretation of peripheral blood smear). Some specialized hematology & chemistry testing performed & resulted on-site. On-site interpretation for routine & specialized testing is available. <p><i>Non-urgent testing (on or off-site):</i></p> <ul style="list-style-type: none"> Same as Tier C. 	<p><i>POCT:</i></p> <p>Same as Tier D.</p> <p><i>On-site testing:</i></p> <p>Same as Tier D plus:</p> <ul style="list-style-type: none"> Performs some specialized hematology & chemistry testing on-site. Independent interpretation & judgement may be required for routine tests. Tests are interpreted on-site. Range of urgent & routine hematology & chemistry tests performed & resulted on-site is broader than at Tier D (e.g., sweat testing analysis). <p><i>Non-urgent testing (on or off-site):</i></p> <ul style="list-style-type: none"> Same as Tier D. 	<p><i>POCT:</i></p> <p>Same as Tier E.</p> <p><i>On-site testing:</i></p> <p>Same as Tier E plus:</p> <ul style="list-style-type: none"> Performs hematology & chemistry tests requiring <i>pediatric-specific</i> equipment &/or methods &/or <i>pediatric</i> subspecialty interpretation & judgement. <p><i>Non-urgent testing (on or off-site):</i></p> <ul style="list-style-type: none"> Same as Tier E. <p><i>Provincial role:</i></p> <ul style="list-style-type: none"> Works with HAS & Lab Agency to make recommendations for a minimum set of tests to be available on-site at Tier B.

	Prevention, Primary & Emergent Lab Services	General Lab Services	Maternal, Neonatal &/or Pediatric-Focused Lab Services	Maternal, Neonatal &/or Pediatric Comprehensive Lab Services	Maternal, Neonatal &/or Pediatric Regional Subspecialty Lab Services	Maternal, Neonatal &/or Pediatric Provincial Subspecialty Lab Services
	Tier A	Tier B	Tier C	Tier D	Tier E	Tier F
Microbiology	<p><i>Non-urgent testing (on or off-site):</i></p> <ul style="list-style-type: none"> Process in place to access non-urgent microbiology testing & results. 	<p><i>Non-urgent testing (on or off-site):</i></p> <ul style="list-style-type: none"> Same as Tier A. 	<p><i>Non-urgent testing (on or off-site):</i></p> <ul style="list-style-type: none"> Same as Tier B. <p><i>Urgent testing (on or off-site):</i></p> <ul style="list-style-type: none"> Access to urgent microbiology testing & results. 	<p><i>Non-urgent testing (on or off-site):</i></p> <ul style="list-style-type: none"> Same as Tier C. <p><i>Urgent testing (on or off-site):</i></p> <ul style="list-style-type: none"> Access to urgent microbiology testing & results. Test menu includes rapid microbiological testing as per national & provincial pediatric guidelines. 	<p><i>Non-urgent testing (on or off-site):</i></p> <ul style="list-style-type: none"> Same as Tier D. <p><i>Urgent testing (on or off-site):</i></p> <ul style="list-style-type: none"> Same as Tier D. <p>If PICU on-site:</p> <ul style="list-style-type: none"> NAT panels for a range of respiratory pathogens <24 hrs (influenza, RSV, Adenoviruses, Mycoplasma pneumonia and many others). 	<p><i>Non-urgent testing (on or off-site):</i></p> <p>Same as Tier E plus:</p> <ul style="list-style-type: none"> Performs acute & specialized maternal & pediatric microbiology testing for the province (e.g., CF Clinic, oncology program, transplant program). <p><i>Urgent testing (on or off-site):</i></p> <ul style="list-style-type: none"> Same as Tier E. <p>If PICU on-site:</p> <ul style="list-style-type: none"> Same as Tier E.
Genetics	<p><i>Non-urgent testing:</i></p> <ul style="list-style-type: none"> Process in place to access non-urgent constitutional genetic testing & results. 	<p><i>Non-urgent testing:</i></p> <ul style="list-style-type: none"> Same as Tier A. 	<p><i>Non-urgent testing:</i></p> <ul style="list-style-type: none"> Same as Tier B. 	<p><i>Non-urgent testing:</i></p> <ul style="list-style-type: none"> Same as Tier C. <p><i>Urgent testing (on or off-site):</i></p> <ul style="list-style-type: none"> Process in place to access urgent constitutional genetic testing & results. 	<p><i>Non-urgent testing:</i></p> <ul style="list-style-type: none"> Same as Tier D. <p><i>Urgent testing (on or off-site):</i></p> <ul style="list-style-type: none"> Same as Tier D. 	<p><i>Non-urgent testing:</i></p> <p>Same as Tier E.</p> <p><i>Urgent testing (on or off-site):</i></p> <ul style="list-style-type: none"> Same as Tier E. <p>Plus:</p> <ul style="list-style-type: none"> Performs & directs urgent & non-urgent genetic testing for the province for constitutional genetics (prenatal/pediatric/ adult) and, as appropriate, pediatric oncology.

	Prevention, Primary & Emergent Lab Services	General Lab Services	Maternal, Neonatal &/or Pediatric-Focused Lab Services	Maternal, Neonatal &/or Pediatric Comprehensive Lab Services	Maternal, Neonatal &/or Pediatric Regional Subspecialty Lab Services	Maternal, Neonatal &/or Pediatric Provincial Subspecialty Lab Services
	Tier A	Tier B	Tier C	Tier D	Tier E	Tier F
Provincial newborn & prenatal screening program & biochemical genetics	Access to provincial newborn & prenatal screening program & biochemical genetics.	Same as Tier A.	Same as Tier B.	Same as Tier C.	Same as Tier D.	Oversees the provincial (1) newborn screening; & (2) prenatal screening laboratories. Develops, maintains & disseminates provincial: <ul style="list-style-type: none"> Guidelines; & Algorithms & tools (e.g., patient & parent handouts) for follow-up of normal & abnormal results.
Anatomic pathology	<p><i>Maternal testing:</i></p> <ul style="list-style-type: none"> Process in place to access general examination of placenta & products of conception following early miscarriage. Process in place to access maternal/fetal autopsy services. <p><i>Pediatric testing:</i></p> <ul style="list-style-type: none"> Process in place to access pediatric anatomical pathology testing & results. Process in place to access pediatric autopsy services. 	<p><i>Maternal testing:</i></p> <ul style="list-style-type: none"> Same as Tier A. <p><i>Pediatric testing:</i></p> <ul style="list-style-type: none"> Same as Tier A. 	<p><i>Maternal testing:</i></p> <ul style="list-style-type: none"> Same as Tier B. <p><i>Pediatric testing:</i></p> <ul style="list-style-type: none"> Same as Tier B. 	<p><i>Maternal testing:</i></p> <ul style="list-style-type: none"> Performs general examination of placenta & products of conception following early miscarriage. Process in place to access pediatric/fetal autopsy services. <p><i>Pediatric testing:</i></p> <ul style="list-style-type: none"> Performs general pediatric anatomical pathology testing on-site. Range of tests correlates to the procedures/ surgeries performed on-site (e.g., appendix, hernia, skin lesions). 	<p><i>Maternal testing:</i></p> <p>Same as Tier D.</p> <p><i>Pediatric testing:</i></p> <ul style="list-style-type: none"> Same as Tier D except the range of tests also supports the pediatric subspecialties available on-site. 	<p><i>Maternal testing:</i></p> <p>Same as Tier E plus:</p> <ul style="list-style-type: none"> Performs specialized examination of placentas & products of conception following early miscarriage. Performs fetal/pediatric autopsies. <p><i>Pediatric testing:</i></p> <ul style="list-style-type: none"> Performs specialized pediatric anatomical pathology testing & results.

	Prevention, Primary & Emergent Lab Services	General Lab Services	Maternal, Neonatal &/or Pediatric-Focused Lab Services	Maternal, Neonatal &/or Pediatric Comprehensive Lab Services	Maternal, Neonatal &/or Pediatric Regional Subspecialty Lab Services	Maternal, Neonatal &/or Pediatric Provincial Subspecialty Lab Services
	Tier A	Tier B	Tier C	Tier D	Tier E	Tier F
Transfusion medicine	<p><i>Non-urgent testing (on or off-site):</i></p> <ul style="list-style-type: none"> Process in place to access non-urgent pre-transfusion testing. 	<p><i>Non-urgent testing (on or off-site):</i></p> <ul style="list-style-type: none"> Same as Tier A. <p><i>On-site testing:</i></p> <ul style="list-style-type: none"> Performs, results & interprets the following: ABO/D, Group & Screen (GS). 	<p><i>Non-urgent testing (on or off-site):</i></p> <ul style="list-style-type: none"> Same as Tier B. <p><i>Urgent testing (on or off-site):</i></p> <ul style="list-style-type: none"> Access to urgent pre-transfusion testing. <p><i>On-site testing:</i></p> <ul style="list-style-type: none"> Performs, results & interprets a limited range of transfusion medicine tests on-site: ABO/D, Group & Screen (GS) & limited crossmatching (electronic cross matches where available). 	<p><i>Non-urgent testing (on or off-site):</i></p> <ul style="list-style-type: none"> Same as Tier C. <p><i>Urgent testing (on or off-site):</i></p> <ul style="list-style-type: none"> Performs, results & interprets urgent on-site pre-transfusion testing. <p><i>On-site testing:</i></p> <p>Same as Tier C plus:</p> <ul style="list-style-type: none"> Performs, results & interprets a limited range of transfusion medicine tests on-site, including antibody identification & investigations. Refers complex antibody investigations to Tier E, F or Canadian Blood Services (CBS). 	<p><i>Non-urgent testing (on or off-site):</i></p> <ul style="list-style-type: none"> Same as Tier D. <p><i>Urgent testing (on or off-site):</i></p> <ul style="list-style-type: none"> Same as Tier D. <p><i>On-site testing:</i></p> <p>Same as Tier D plus:</p> <ul style="list-style-type: none"> Performs some complex antibody investigations on-site (e.g., neonatal exchange transfusion & neonatal top-up transfusion for low birthweight neonates). Refers others to Tier F or CBS. 	<p><i>Non-urgent testing (on or off-site):</i></p> <ul style="list-style-type: none"> Same as Tier E. <p><i>Urgent testing (on or off-site):</i></p> <ul style="list-style-type: none"> Same as Tier E. <p><i>On-site testing:</i></p> <p>Same as Tier E plus:</p> <ul style="list-style-type: none"> Performs a broader range of complex antibody investigations on-site than Tier E (e.g., pediatric ECMO, intrauterine transfusion, pediatric exchange transfusion for common hemoglobinopathies including sickle cell disease, pediatric stem cell transplant. Refers some tests to CBS. <p>Aligns with provincial programs such as pediatric cardiac surgery, oncology, hematology & bone marrow transplant.</p> <p>Provides leadership & works collaboratively with HAs & CBS to support obstetric/maternal antibody monitoring practices.</p>

	Prevention, Primary & Emergent Lab Services	General Lab Services	Maternal, Neonatal &/or Pediatric-Focused Lab Services	Maternal, Neonatal &/or Pediatric Comprehensive Lab Services	Maternal, Neonatal &/or Pediatric Regional Subspecialty Lab Services	Maternal, Neonatal &/or Pediatric Provincial Subspecialty Lab Services
	Tier A	Tier B	Tier C	Tier D	Tier E	Tier F
4. Availability of plasma protein & fresh blood components						
Availability of plasma protein products and fresh blood components ³		<p>On-site storage of limited inventory of plasma protein products (neonates or children requiring blood components will usually be transferred to a higher tier).</p> <p>Compliant with recommendations from the BC Transfusion Medicine Advisory Group (TMAG) Clinical Guidelines for the Appropriate Use of Blood Components in Neonates and Infants Less than 4 Months of Age.^{17,18}</p>	<p>Same as Tier B plus:</p> <ul style="list-style-type: none"> Standard plasma protein products & blood components stored on-site, including most RBC groups (i.e. O, A, B) and other products such as: plasma, albumin, and Rh Immunoglobulin (Rhlg). Others obtained from off-site as required. <p>Processes in place for provision of emergency unmatched neonatal or pediatric transfusion.</p>	<p>Same as Tier C plus:</p> <ul style="list-style-type: none"> Standard plasma protein products & blood components stored on-site, including all RBC groups and other products such as: factor VIII & IX replacement, plasma, albumin, cryoprecipitate/fibrinogen, varicella zoster immune globulin (VZIG), hepatitis immune globulin (HBIG) & Rh Immunoglobulin (Rhlg). Others obtained from off-site as required. 	<p>Same as Tier D plus:</p> <ul style="list-style-type: none"> Specialized plasma protein products & blood components stored on-site 24/7 (e.g. factor VIII & prothrombin concentrates). 	<p>Same as Tier E plus:</p> <ul style="list-style-type: none"> On-site storage of more extensive inventory of plasma protein products. More extensive plasma protein products & components stored on-site for emergency use, including: <ul style="list-style-type: none"> Group O RBCs AB plasma. <p>Rare plasma protein products & blood components may be obtained from off-site lab for <u>planned</u> administration on a "case by case" basis (e.g., child with cancer or hemophilia living in the community).</p>

³ BC guidelines recommend transfer to a facility where aliquoting capabilities exist for transfusions in newborns and infants up to 4 months of age.

	Prevention, Primary & Emergent Lab Services	General Lab Services	Maternal, Neonatal &/or Pediatric-Focused Lab Services	Maternal, Neonatal &/or Pediatric Comprehensive Lab Services	Maternal, Neonatal &/or Pediatric Regional Subspecialty Lab Services	Maternal, Neonatal &/or Pediatric Provincial Subspecialty Lab Services
	Tier A	Tier B	Tier C	Tier D	Tier E	Tier F
Availability of plasma protein products and fresh blood components cont'd		<p>Limited plasma protein products & components stored on-site for emergency use, including:</p> <ul style="list-style-type: none"> • Group O RBCs • AB plasma. <p>Plasma protein products & blood components may be obtained from off-site lab for <u>planned</u> administration on a "case by case" basis (e.g., child with cancer or hemophilia living in the community).</p>		<p>Specialized plasma protein products & blood components stored on-site (platelets, cryoprecipitate/fibrinogen, factor replacement, immune globulins). Others obtained from off-site as required.</p> <p>Pools & aliquots blood components for routine, non-emergency pediatric transfusions on days, M-F.</p>	<p>Pools, aliquots, &/or plasma reduces blood components & prepares components for routine, non-emergency & emergency transfusions 24/7. Biological safety cabinet used for preparing aliquots.</p> <p>Reconstitutes whole blood for neonatal exchange.</p> <p>Irradiates RBC & platelets on-site or has access to irradiated RBCs & platelets within 4 hours.</p>	<p>Pools, aliquots &/or plasma reduces blood components & prepares components for routine, non-emergency & emergency transfusions 24/7. Biological safety cabinet used for preparing aliquots.</p> <p>Blood irradiator and cell washer available on-site.</p> <p>Specialized product support for intrauterine transfusion available on-site.</p> <p>Performs testing and provides consultation for provincial pediatric hematology blood and oncology transplant program.</p>

	Prevention, Primary & Emergent Lab Services	General Lab Services	Maternal, Neonatal &/or Pediatric-Focused Lab Services	Maternal, Neonatal &/or Pediatric Comprehensive Lab Services	Maternal, Neonatal &/or Pediatric Regional Subspecialty Lab Services	Maternal, Neonatal &/or Pediatric Provincial Subspecialty Lab Services
	Tier A	Tier B	Tier C	Tier D	Tier E	Tier F
5. Provincial consultation						
a. Provincially delivered programs						<p>Provides professional consultation & expertise to provincially delivered programs based at C&W such as:</p> <ul style="list-style-type: none"> • Pediatric autopsy • Developmental (fetal) pathology, reproductive pathology • Inherited & high risk prenatal laboratory genetics & genomics • Biochemical genetics • Prenatal screening • Newborn screening • Pediatric oncology • Stem cell transplants • Intrauterine transfusion medicine
b. Complex/high acuity maternal/fetal, neonatal & pediatric cases						<p>Provides professional consultation & expertise in complex / high acuity maternal/fetal, neonatal & pediatric care to:</p> <ul style="list-style-type: none"> • C&W clinical programs (on-site & on-call). • Physicians, laboratory staff, nurses & other health care providers throughout the province 24/7 (by distance). <p>Maximizes the use of technology to share expertise provincially (e.g., telelab).</p>
c. Resource to Lab Agency & Ministry of Health (MOH)						<p>Offers support to the Lab Agency & MOH on the review of pediatric, maternal and genetic (constitutional) laboratory tests performed outside BC to determine the appropriateness & cost-effectiveness of performing the tests in BC.</p>

5.2.1.2 Requirements

	Prevention, Primary & Emergent Lab Services	General Lab Services	Maternal, Neonatal &/or Pediatric-Focused Lab Services	Maternal, Neonatal &/or Pediatric Comprehensive Lab Services	Maternal, Neonatal &/or Pediatric Regional Subspecialty Lab Services	Maternal, Neonatal &/or Pediatric Provincial Subspecialty Lab Services
	Tier A	Tier B	Tier C	Tier D	Tier E	Tier F
1. Personnel						
a. Professional services (medical & clinical scientist)	Oversight provided by designated pathologist days, M-F.	Same as Tier A plus: Pathologist within HA available by telephone for clinical consultation 24/7.	Same as Tier B.	Same as Tier C plus: Pathologist(s) available on-site days, M-F. May include general pathology, medical biochemistry, medical microbiology, anatomical pathology, hematopathology/transfusion medicine.	Same as Tier D plus: Pathologist(s) available on-site days, M-F. May include general pathology, medical biochemistry, medical microbiology, anatomical pathology, hematopathology/transfusion medicine, neuropathology.	Maternal/pediatric subspecialist(s) available on-site for: <ul style="list-style-type: none"> • Laboratory medicine <ul style="list-style-type: none"> •*Medical/ clinical biochemistry •*Biochemical diseases •Constitutional genetics & genomics •*Medical microbiology, virology & infection control •Immunology • Pathology <ul style="list-style-type: none"> •*Hematopathology/ transfusion medicine •*Anatomical pathology •*Neuropathology <p>All maternal/pediatric subspecialists available on-site days M-F. Subspecialists marked with * available on-call after hours & available to come on-site, as required.</p> <p>Maternal/pediatric subspecialty knowledge & skills acquired through a fellowship or clinical experience in the specified area. Knowledge & skills are maintained through ongoing clinical experience & continuing medical education (CME), the majority of which is in the subspecialty area.</p>

	Prevention, Primary & Emergent Lab Services	General Lab Services	Maternal, Neonatal &/or Pediatric-Focused Lab Services	Maternal, Neonatal &/or Pediatric Comprehensive Lab Services	Maternal, Neonatal &/or Pediatric Regional Subspecialty Lab Services	Maternal, Neonatal &/or Pediatric Provincial Subspecialty Lab Services
	Tier A	Tier B	Tier C	Tier D	Tier E	Tier F
b. Technical services	If on-site laboratory testing is performed (other than POCT), staffing is as per Tier B.	MLTs &/or Combined Laboratory & X-Ray Technologists &/or MLAs. Registered Nurses (RNs) may perform blood collection.	Same as Tier B.	MLTs & MLAs. RNs may perform blood collection. Through regular exposure, blood collectors have acquired specific expertise in maternal/fetal, neonate & pediatric laboratory collecting. Access to transfusion medicine technical consultation/ support (on-site or by phone) on days, M-F.	MLTs & MLAs. RNs may perform blood collection. Through regular exposure, blood collectors have acquired specific expertise in maternal/fetal, neonate & pediatric laboratory collecting. MLTs with expertise & experience in molecular microbiology available for rapid diagnosis. e.g., MRSA. MLTs & MLAs have received additional training & receive regular exposure to pediatric laboratory procedures, including small volume analyses. MLTs with expertise in transfusion medicine available on-site days, M-F. Technical team lead/specialist(s) in transfusion medicine available on site days, M-F.	Same as Tier E plus: <ul style="list-style-type: none"> • MLTs with expertise & experience in molecular microbiology available for rapid diagnosis 7 d/wk. e.g., MRSA. • MLTs with training in developmental (fetal) pathology. • Certified Pathologist Assistants with specific pediatric pathology training &/or experience. • MLTs with cellular biology degree work in cellular therapy (pediatric stem cell transplant program). • MLTs with formal training in genetics & specialized training &/or experience in pediatric oncology & high risk prenatal genetic / genomic testing & analysis.

	Prevention, Primary & Emergent Lab Services	General Lab Services	Maternal, Neonatal &/or Pediatric-Focused Lab Services	Maternal, Neonatal &/or Pediatric Comprehensive Lab Services	Maternal, Neonatal &/or Pediatric Regional Subspecialty Lab Services	Maternal, Neonatal &/or Pediatric Provincial Subspecialty Lab Services
	Tier A	Tier B	Tier C	Tier D	Tier E	Tier F
2. Regulations						
a. Accreditation & other requirements	<p>Diagnostic Accreditation Program</p> <p>Hospital Quality assurance requirements – including formal quality reviews.</p>	<p>Same as Tier A plus:</p> <p>Health Canada - Guidance Document: Blood Regulations.</p> <p>Canadian Standards Association (CSA) Z901-10 Blood & Blood Components.</p> <p>Human Pathogens & Toxins Act Registration if providing on-site microbiology services (includes requirements for a biosafety cabinet).</p>	Same as Tier B.	Same as Tier C.	<p>Same as Tier D plus:</p> <p>Health Canada - Transfusion Medicine & Cellular Therapy.</p> <p>General Nuclear Safety & Control Regulations (Canadian Nuclear Safety Commission).</p>	<p>Same as Tier E plus:</p> <p>FACT accreditation – Cellular Therapy.</p>

5.2.2 Knowledge Sharing & Transfer/Training

		Prevention, Primary & Emergent Lab Services	General Lab Services	Maternal, Neonatal &/or Pediatric-Focused Lab Services	Maternal, Neonatal &/or Pediatric Comprehensive Lab Services	Maternal, Neonatal &/or Pediatric Regional Subspecialty Lab Services	Maternal, Neonatal &/or Pediatric Provincial Subspecialty Lab Services
		Tier A	Tier B	Tier C	Tier D	Tier E	Tier F
1.0	Student Learning						
1.1	Medical & clinical science students, residents & fellows						
	a. Teaching expectations		Prime or exclusive focus is to provide, promote & advance excellence in clinical service & patient care. No formal expectations for teaching or research, although may be involved in either activity.	Same as Tier B.	Major or predominant focus is to provide, promote & advance excellence in clinical service & patient care. Contributes to education by involvement in undergraduate medical teaching, ⁴ clinically integrated teaching ⁵ or both. May be involved in research. Teaching is not specific to <i>fetal/maternal, newborn or pediatric</i> pathology.	Same as Tier D.	Work spans the spectrum of clinical & academic activities including provision, promotion and advancement of excellence in clinical service & patient care, education, including undergraduate, graduate & post-graduate teaching, clinically integrated teaching and more and research. Teaching is specific to <i>fetal/maternal, newborn & pediatric</i> pathology & laboratory medicine.

⁴ Teaching done without patient care: structured (e.g., lectures, seminars, tutorials) & non-structured (e.g., 1:1 mentorship & supervision of students/residents/ fellows).

⁵ Teaching done simultaneously with patient care & clinical service delivery.

		Prevention, Primary & Emergent Lab Services	General Lab Services	Maternal, Neonatal &/or Pediatric-Focused Lab Services	Maternal, Neonatal &/or Pediatric Comprehensive Lab Services	Maternal, Neonatal &/or Pediatric Regional Subspecialty Lab Services	Maternal, Neonatal &/or Pediatric Provincial Subspecialty Lab Services
		Tier A	Tier B	Tier C	Tier D	Tier E	Tier F
	c. Academic classification		Classified as a <i>Clinical Centre</i> in the Academic Pathology Workload Framework Model. ¹⁹	Classified as a <i>Clinical Centre</i> in the Academic Pathology Workload Framework Model.	Classified as a <i>Clinical Academic Centre 2</i> in the Academic Pathology Workload Framework Model.	Classified as a <i>Clinical Academic Centre 1</i> in the Academic Pathology Workload Framework Model.	Classified as a <i>Comprehensive Clinical Academic Centre</i> in the Academic Pathology Workload Framework Model.
	c. Pediatric & obstetric-specific accreditations						Accredited training site (Royal College of Physicians & Surgeons of Canada) for specialty & subspecialty residents including pathology, pediatrics, pediatric subspecialties, obstetrics, maternal/fetal medicine & medical genetics. Training site for fellowships in pediatric pathology & pediatric subspecialties (e.g., medical genetics, pediatric subspecialties & maternal-fetal medicine). Accredited as Comprehensive Centre for Clinical Genetics Service & Training (Canadian College of Medical Geneticists).

		Prevention, Primary & Emergent Lab Services	General Lab Services	Maternal, Neonatal &/or Pediatric-Focused Lab Services	Maternal, Neonatal &/or Pediatric Comprehensive Lab Services	Maternal, Neonatal &/or Pediatric Regional Subspecialty Lab Services	Maternal, Neonatal &/or Pediatric Provincial Subspecialty Lab Services
		Tier A	Tier B	Tier C	Tier D	Tier E	Tier F
1.2	MLTs & MLAs						
	Teaching expectations		Laboratory training experiences/placements available for MLTs &/or MLAs (not pediatric-specific). Negotiated between the site & applicable learning institution (e.g., BCIT, College of New Caledonia, Thompson-River University).	Laboratory training experiences/placements available for MLTs & MLAs (not pediatric-specific). Negotiated between the site & applicable learning institution (e.g., BCIT, College of New Caledonia, Thompson-River University).	Same as Tier C plus: Broader range of experiences than Tier C and includes all disciplines.	Same as Tier D plus: Broader range of experiences than Tier D and includes all disciplines.	<i>Pediatric-specific</i> laboratory training experiences/placements available for MLTs & MLAs. Negotiated between the site & applicable learning institution (e.g., BCIT, College of New Caledonia, Thompson-River University). Designated by BCIT as training site for clinical laboratory genetic MLTs.

		Prevention, Primary & Emergent Lab Services	General Lab Services	Maternal, Neonatal &/or Pediatric-Focused Lab Services	Maternal, Neonatal &/or Pediatric Comprehensive Lab Services	Maternal, Neonatal &/or Pediatric Regional Subspecialty Lab Services	Maternal, Neonatal &/or Pediatric Provincial Subspecialty Lab Services
		Tier A	Tier B	Tier C	Tier D	Tier E	Tier F
2.0	Continuing Education						
2.1	Professionals (physicians & clinical scientists)						
	a. Maintenance of competencies				<p>Facilitates access to learning activities that support the maintenance of physician competencies in laboratory medicine (not maternal/fetal, neonatal or pediatric-specific).</p> <p>Facilitates participation in relevant HA & provincial maternal/fetal, neonatal & pediatric laboratory learning activities (e.g., rounds & conferences).</p>	Same as Tier D.	<p>Facilitates access to learning activities that support the maintenance of physician competencies in laboratory medicine (specific to maternal/fetal, neonatal & pediatrics).</p> <p>Facilitates participation in relevant HA & provincial maternal/fetal, neonatal & pediatric laboratory learning activities (e.g., rounds & conferences).</p> <p>Mechanisms in place to regularly review physician & clinical scientist education needs related to maintenance of maternal/fetal, neonatal & pediatric laboratory competencies.</p> <p>Provides pediatric clinical laboratory experiences for Tier A, B, C, D & E physicians & clinical scientists upon request (on-site &/or via virtual care).</p>

		Prevention, Primary & Emergent Lab Services	General Lab Services	Maternal, Neonatal &/or Pediatric-Focused Lab Services	Maternal, Neonatal &/or Pediatric Comprehensive Lab Services	Maternal, Neonatal &/or Pediatric Regional Subspecialty Lab Services	Maternal, Neonatal &/or Pediatric Provincial Subspecialty Lab Services
		Tier A	Tier B	Tier C	Tier D	Tier E	Tier F
	b. Provincial resource						Develops & shares educational resources & partners with HAs, provincial & national organizations to offer province-wide learning activities that support the maintenance of physician & clinical scientist competencies in maternal, neonatal & pediatric laboratory medicine (e.g., organizing & presenting at relevant conferences, developing learning modules). Utilizes technology to maximize the accessibility of educational resources & programs.

		Prevention, Primary & Emergent Lab Services	General Lab Services	Maternal, Neonatal &/or Pediatric Focused Lab Services	Maternal, Neonatal &/or Pediatric Comprehensive Lab Services	Maternal, Neonatal &/or Pediatric Regional Subspecialty Lab Services	Maternal, Neonatal &/or Pediatric Provincial Subspecialty Lab Services
		Tier A	Tier B	Tier C	Tier D	Tier E	Tier F
2.2	MLTs & MLAs						
	a. Maintenance of competencies	If on-site laboratory testing is performed (other than POCT), expectations are as per Tier B.	<p>Facilitates access to learning activities that support the maintenance of MLT &/or MLA competencies in maternal, neonatal & pediatric laboratory medicine (e.g., on-line access to guidelines/ reference materials, continuing education courses).</p> <p>Facilitates participation in relevant HA & provincial learning activities (e.g., maternal/fetal, neonatal & pediatric laboratory rounds & conferences).</p> <p>Mechanisms in place to regularly review MLT &/or MLA education needs related to maintenance of maternal/fetal, neonatal & pediatric competencies.</p> <p>Facilitates MLT &/or MLA access to learning activities based on identified practice gaps, including the practice of critical clinical skills where limited opportunity exists in practice (e.g., virtual care, clinical experience with higher tier service).</p>	<p>Facilitates access to learning activities that support the maintenance of MLT & MLA competencies in maternal, neonatal & pediatric laboratory medicine (e.g., on-line access to guidelines/ reference materials, continuing education courses).</p> <p>Facilitates participation in relevant HA & provincial learning activities (e.g., maternal/fetal, neonatal & pediatric laboratory rounds & conferences).</p> <p>Mechanisms in place to regularly review MLT & MLA education needs related to maintenance of maternal/fetal, neonatal & pediatric competencies.</p> <p>Facilitates MLT & MLA access to learning activities based on identified practice gaps, including the practice of critical clinical skills where limited opportunity exists in practice (e.g., virtual care, clinical experience with higher tier service).</p>	Same as Tier C.	Same as Tier D.	<p>Same as Tier E plus:</p> <p>Provides pediatric clinical laboratory experiences for Tier A, B, C, D & E MLTs & MLAs upon request (on-site &/or via virtual care).</p>

		Prevention, Primary & Emergent Lab Services		Maternal, Neonatal &/or Pediatric-Focused Lab Services	Maternal, Neonatal &/or Pediatric Comprehensive Lab Services	Maternal, Neonatal &/or Pediatric Regional Subspecialty Lab Services	Maternal, Neonatal &/or Pediatric Provincial Subspecialty Lab Services
		Tier A	Tier B	Tier C	Tier D	Tier E	Tier F
	b. Provincial resource						Develops & shares educational resources & partners with HAs, provincial & national organizations to offer province-wide learning activities that support the maintenance of MLT & MLA competencies in maternal, neonatal & pediatric laboratory medicine (e.g., organizing & presenting at relevant conferences, developing learning modules).

5.2.3 Quality Improvement & Research

		Prevention, Primary & Emergent Lab Services	General Lab Services	Maternal, Neonatal &/or Pediatric-Focused Lab Services	Maternal, Neonatal &/or Pediatric Comprehensive Lab Services	Maternal, Neonatal &/or Pediatric Regional Subspecialty Lab Services	Maternal, Neonatal &/or Pediatric Provincial Subspecialty Lab Services
		Tier A	Tier B	Tier C	Tier D	Tier E	Tier F
1.0	Quality Improvement (QI)						
	a. Structures & processes	If on-site laboratory testing is performed (other than POCT), expectations are as per Tier B.	HA laboratory QI structures, processes & reporting mechanisms in place including case reviews. QI structures & processes are <i>not</i> maternal/fetal, neonatal or pediatric specific.	Same as Tier B.	Same as Tier C.	Same as Tier D.	HA laboratory QI structures, processes & reporting mechanisms in place including case reviews. QI structures & processes <i>are</i> maternal/fetal, neonatal & pediatric specific (e.g., program & department mortality review rounds & multidisciplinary diagnostic rounds). Implements recommendations.
	b. Quality reviews	If on-site laboratory testing is performed (other than POCT), expectations are as per Tier B.	For HA's that qualify for protection under the BC Evidence Act (Section 51), a process is in place that allows for a multi-agency review to convene in an effort to improve patient care. Reference: Multi agency quality processes: Considerations for convening quality reviews and establishing quality committees involving multiple health system agencies in BC" (Jan 2016).	Same as Tier B.	Participates in relevant maternal/fetal, neonatal & pediatric-focused quality reviews within existing hospital or HA structures.	Same as Tier D.	Provides maternal, neonatal &/or pediatric laboratory expertise for case and program reviews at other tiers, if requested. Consults with experts outside BC for Tier F case reviews, as appropriate.

		Prevention, Primary & Emergent Lab Services	General Lab Services	Maternal, Neonatal &/or Pediatric-Focused Lab Services	Maternal, Neonatal &/or Pediatric Comprehensive Lab Services	Maternal, Neonatal &/or Pediatric Regional Subspecialty Lab Services	Maternal, Neonatal &/or Pediatric Provincial Subspecialty Lab Services
		Tier A	Tier B	Tier C	Tier D	Tier E	Tier F
	c. QI Initiatives	If on-site laboratory testing is performed (other than POCT), expectations are as per Tier B.	Participates in regional & provincial improvement initiatives related to maternal/fetal, neonatal & pediatric laboratory medicine.	Same as Tier B.	Same as Tier C plus: In collaboration with Tier E &/or F, leads <i>regional</i> improvement initiatives related to maternal/fetal, neonatal & pediatric laboratory medicine.	Same as Tier D.	Same as Tier E plus: In collaboration with HAs & colleagues in other Tiers, establishes, collects & tracks provincial maternal, neonatal, & pediatric laboratory quality indicators (e.g., quality of specimen collection, turnaround times, etc). In collaboration with HAs & colleagues in other Tiers, leads <i>provincial</i> quality improvement initiatives related to maternal/fetal, neonatal & pediatric laboratory medicine. In collaboration with researchers, HAs & colleagues in other Tiers, leads pilot projects assessing clinical utility of emerging diagnostic & screening technologies in maternal/fetal, neonatal, & pediatric laboratory medicine. Establishes standards of care for the province in these areas.

		Prevention, Primary & Emergent Lab Services	General Lab Services	Maternal, Neonatal &/or Pediatric-Focused Lab Services	Maternal, Neonatal &/or Pediatric Comprehensive Lab Services	Maternal, Neonatal &/or Pediatric Regional Subspecialty Lab Services	Maternal, Neonatal &/or Pediatric Provincial Subspecialty Lab Services
		Tier A	Tier B	Tier C	Tier D	Tier E	Tier F
	d. BC Patient Safety Learning System (BC PSLs)	If on-site laboratory testing is performed (other than POCT), expectations are as per Tier B.	Reviews trends at a local level of hazards, adverse events & near misses (including laboratory related maternal/fetal, neonatal & pediatric cases) as per reports generated from the BC PSLs. Takes local action to reduce future occurrences.	Same as Tier B.	Reviews trends at a HA level of hazards, adverse events & near misses (including laboratory related maternal/fetal, neonatal & pediatric cases) as per reports generated from the BC PSLs. Takes local action to reduce future occurrences.	Same as Tier D.	Same as Tier E plus: Reviews trends at a provincial level of hazards, adverse events & near misses involving laboratory related maternal/fetal, neonatal & pediatric cases as per reports generated from the BC PSLs. Takes provincial action to reduce future occurrences.
	e. Standard-based care		System supports are in place to enable laboratory providers to provide care that is consistent with current provincial maternal/fetal, neonatal & pediatric laboratory guidelines.	Same as Tier B.	Same as Tier C.	Same as Tier D.	Develops & disseminates guidelines & standards for maternal/fetal, neonatal & pediatric laboratory medicine in BC. Supports the provision of guideline-based care.
	f. National & international networks						Actively participates in national & international networks for maternal/fetal, neonatal & pediatric laboratory, pathology & transfusion medicine. Promotes adoption of best practices in BC.

		Prevention, Primary & Emergent Lab Services	General Lab Services	Maternal, Neonatal &/or Pediatric-Focused Lab Services	Maternal, Neonatal &/or Pediatric Comprehensive Lab Services	Maternal, Neonatal &/or Pediatric Regional Subspecialty Lab Services	Maternal, Neonatal &/or Pediatric Provincial Subspecialty Lab Services
		Tier A	Tier B	Tier C	Tier D	Tier E	Tier F
2.0	Research						
	a. Research activities		Prime or exclusive focus is to provide, promote & advance excellence in clinical service & patient care. No formal expectations for teaching or research.	Same as Tier B plus: May participate in research. Teaching is not likely specific to <i>fetal/maternal, newborn or pediatric</i> pathology.	Same as Tier C plus: Participates in research. Teaching is not likely specific to <i>fetal/maternal, newborn or pediatric</i> pathology.	Same as Tier D.	Conducts independent & collaborative research into issues relevant to maternal/fetal, neonatal & pediatric health. May include basic research, ⁶ translational research ⁷ & clinical applied research. ⁸ Works in conjunction with associated/affiliated research centres or institutes (e.g., Women's Health Research Institute, Children & Family Research Institute). Classified as a <i>Comprehensive Clinical Academic Centre</i> in the Academic Pathology Workload Framework Model.
	b. Research structures						Provides a research support structure to facilitate research in pediatric pathology & laboratory medicine.

⁶ Basic research: Study of the fundamental causes & mechanisms of health and disease, and includes education scholarship.

⁷ Translational research: Process of transforming basic research discoveries into improved clinical practice and patient care, including innovation, test development and implementation.

⁸ Clinical applied research: Research that refines or redefines diseases, identifies novel diseases or disease phenotypes and evaluates, appraises and reports on clinical practice in a hospital, including existing and novel therapies and health care system, to continually maintain and improve the safety and quality of patient care. Includes maternal/fetal, neonatal & pediatric focused Strategy for Patient-Oriented Research (SPOR).

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Appendix 1: Mother-Baby Togetherness during Blood Collection to Minimize Procedural Pain

Module requirement: Tiers A to F:

Procedures are in place to support mother-baby togetherness during blood collection processes to minimize procedural pain (e.g., promote skin-to-skin &/or active breastfeeding).

Examples of ways to promote mother-baby togetherness during blood collection include:

1. Nursing staff:
 - a. Provide information to families on ways to reduce the pain of minor procedures, including blood draws. Such strategies have been shown to:
 - promote stability (respiratory and cardiac, helps maintain infant blood sugars)
 - reduce the likelihood and/or duration of baby crying (decreased stress)
 - encourage colonization with maternal bacteria
 - decrease maternal anxiety and pain
 - improve thermoregulation
 - a. Ways to reduce the pain of minor procedures include:
 - Skin-to-skin care +/- breastfeeding.
 - Non-nutritive sucking (i.e., caregiver puts finger in baby's mouth).
 - Facilitated tucking (caregiver places hands with gentle pressure on baby's legs and arms to maintain a flexed position towards the baby's torso and midline).
 - b. Ensure mother is aware and ready for the lab procedure with baby skin-to-skin. Mother can also be encouraged to hold baby's foot to warm heel.
2. Lab staff:
 - a. Provide positive feedback re skin-to-skin & breastfeeding to mother (e.g., "great you have your baby skin-to-skin as that helps your baby deal with the pain of being poked").
 - b. Use good body mechanics when taking the sample.
 - Mother in bed
 - Adjust height of bed so that you do not have to bend over.
 - Keep your back straight with arms close to the body wrists straight.
 - Apply gentle pressure to the infant's foot & relax hand each time pressure is applied.
 - Mother in chair:
 - Use a stool- slight bend to head, straight back, pillow under baby to raise height of baby.
 - No stool: use kneeling board.

References²⁰⁻²³

Appendix 2: Sample Competency Checklists for Blood Collection on Neonates & Children

Module requirement:

Processes are in place to ensure staff is competent in the collection of neonatal & pediatric specimens. Specifically for blood samples, competencies are assessed upon initial employment & annually thereafter. The assessment is utilized to develop a learning plan to address knowledge/skill deficits & situations where volumes are insufficient to maintain competence (e.g., organize opportunity for staff to spend time at a higher volume neonatal/pediatric site).

The checklists in this Appendix provide a guide for the assessment of competencies required for specific types of blood collections. The applicable skills expected at each tier are as follows:

Tier A	Tier B	Tier C	Tier D	Tier E	Tier F
<ul style="list-style-type: none"> • Heel pokes (<1 yr old) • Finger pokes (>1 yr old) 	Same as Tier A plus: Blood samples include: ^{9, 10} <ul style="list-style-type: none"> • Straight needle with vacutainer holder. • Winged set needle with vacutainer holder <u>&/or</u> syringe. 	Same as Tier B.	Same as Tier C plus: Blood samples include: <ul style="list-style-type: none"> • Winged set needle with vacutainer holder; and • Winged set needle with syringe. 	Same as Tier D.	Same as Tier D.

Competency Checklist: Micro Collection Samples

- Includes heel and finger pokes.

		Yes	No	Comments
Identify patient				
• Asks to spell full name- last and first				
• Asks date of birth				
• Checks PHN and/or facility #				
• Checks gender on the requisition matches blue card and/or armband				
Assemble collection containers				
Outpatient	Inpatient			
Assembles requisitions, collection containers and equipment PRIOR to calling patient into blood collection	Assembles requisitions, collection containers and equipment AFTER patient identification			

⁹ Wing set needle is preferred to a straight needle in the following circumstances: (1) child <5 years old; (2) child <10 yrs old and is anxious or needle phobic; and/or (3) multiple tubes of blood are required.

¹⁰ Vacutainer is preferred if the veins have good integrity. Syringe is preferred for neonates or children with small or scarred veins.

		Yes	No	Comments
room. <i>PS: has needle, winged set and lancet options ready</i>				
Determines phlebotomy method with appropriate needle/micro puncture device i.e. straight needle vs winged set, tube holder vs syringe or heel lancet				
Select site for collection				
Heel <ul style="list-style-type: none"> Lateral or medial plantar surface of the heel 	Finger <ul style="list-style-type: none"> Middle (3rd) or ring (4th) finger Palmar surface of the distal segment of the phalanx Punctures just off the centre and perpendicular to the grooves of the fingerprint 			
Collect blood				
<ul style="list-style-type: none"> Warms puncture site only if indicated 				
<ul style="list-style-type: none"> Cleanses selected site 				
<ul style="list-style-type: none"> Opens new sterile puncture device in view of patient/parent just prior to puncturing the site 				
<ul style="list-style-type: none"> Discards puncture device into Sharps® container 				
<ul style="list-style-type: none"> Wipes first drop of blood with clean unused gauze (sterile gauze for NICU and PICU) 				
<ul style="list-style-type: none"> Selects micro collection container as per order of draw to collect necessary volume of blood 				
<ul style="list-style-type: none"> Avoids “scooping” blood into container and allows blood to flow freely into collection container 				
<ul style="list-style-type: none"> Caps each tube upon completion of the collection and immediately mixes micro collection containers with anticoagulant 				
<ul style="list-style-type: none"> Covers puncture site with gauze 				
<ul style="list-style-type: none"> Applies pressure and elevates hand or foot until bleeding has stopped 				
<ul style="list-style-type: none"> Follows guidelines for applying bandage or gauze adhesive 				
<ul style="list-style-type: none"> Discards gauze and unused supplies 				
Label specimen				
<ul style="list-style-type: none"> MUST occur AFTER blood specimen is drawn 				
<ul style="list-style-type: none"> MUST occur BEFORE leaving the side of the patient 				
<ul style="list-style-type: none"> Verifies information on labeled blood matches inpatient ID band or requests that outpatient/caregiver verify information on labeled specimen is correct. If patient cannot verbally identify themselves, ask caregiver to spell patient's full name (last and first). 				
Cleans hands after removing gloves				

Competency Checklist: Venipuncture Collection Samples

- Includes various combinations of straight vs winged set needle and vacutainer holder vs syringe.

		Yes	No	Comments
Identify patient				
• Asks to spell full name- last and first				
• Asks date of birth				
• Checks PHN and/or facility #				
• Checks gender on the requisition matches blue card and/or armband				
Assemble collection containers				
Outpatient	Inpatient			
Assembles requisitions, collection containers and equipment PRIOR to calling patient into blood collection room. <i>PS: has needle, winged set and lancet options ready</i>	Assembles requisitions, collection containers and equipment AFTER patient identification			
Determine phlebotomy method with appropriate needle/micro puncture device i.e. straight needle vs winged set, tube holder vs syringe or heel lancet				
Collect blood				
Venipuncture – Punctures site ensuring				
• Bevel is up				
• Angle of insertion is 30° or less				
• Site is in a downward position relative to the needle to prevent reflux or backflow				
• Removes tourniquet within 1 minute				
Needle or winged set with tube holder				
• Inserts first blood collection tube into holder as per order of draw				
• Visually confirms that desired volume of blood is reached or in the case of adults and older paediatric patients, that tube is full, vacuum is exhausted and blood flow eases				
• Removes the tube from the tube holder				
• Visually confirms the sleeve re-covers the needlepoint that pierces the tube closure, stopping blood flow				
• Simultaneously mix tubes containing anticoagulant or clot activator by gentle inversion per standard guideline while next tube is filling				
Winged set with syringe				
• Grasps the syringe with the non-dominant hand				
• Pulls the plunger of syringe slowly and lets the blood fill				

	Yes	No	Comments
the syringe to the required amount			
➤ Only Heparin syringe is required			
• Removes cap from syringe and places on the counter with the opening facing upward			
• Attached the heparin syringe the latex free sleeve onto the winged set			
• Grasps the syringe with the non-dominant hand			
• Draws blood up to 0.3ml line by pulling the plunger of the syringe slowly with non-dominant hand			
• Removes heparin syringe from sleeve of winged set tubing			
• Visually inspects syringe for air bubbles			
• If bubbles present <ul style="list-style-type: none"> a. Holds syringe in upright position b. Gently taps syringe body with index finger to force bubbles to top of syringe c. Gently presses plunger to displace bubbles/air out of syringe 			
• Caps the syringe			
• Mixes syringe by placing between palms, with cap pointing up and rolls the syringe 10 times			
• Labels syringe			
• Places on ice pillow pack			
➤ Additional syringe is required			
• Clamps tubing by bending at sleeve end			
• Removes heparin syringe from sleeve and passes to a co-worker to handle as above			
• Holds the sleeve in one hand			
• Holds the empty syringe in the other hand			
• Twists			
• Attaches empty syringe			
• Collects blood			
• Makes needle/winged set safe prior to removing			
Covers needle puncture site gently with gauze (sterile for NICU/PICU) immediately after needle is made safe			
<i>If patient is:</i> Able , instructs patient to apply pressure Not able and no other person is able to apply pressure , uses non dominant hand to apply pressure while proceeding to next step			
Disposes needle directly into Sharps® container			
Dispenses blood into appropriate tubes as per order of draw			
If transferring from syringe to micro collection container			

	Yes	No	Comments
• Removes cap from micro collection container			
• Adds appropriate amount of blood by gently applying pressure to plunger on syringe			
• Caps micro collection container			
• Mixes tube per standard guidelines			
• Discards syringe into Sharps® container			
If transferring to vacuum tubes or blood culture bottles			
• Attaches transfer device to syringe			
• Inserts blood collection tube as per order of draw			
• Visually confirms that desired volume of blood is reached			
• Removes the tube from the transfer device holder			
• Simultaneously mixes tubes containing anticoagulant or clot activator by gentle inversion per standard guidelines while next tube is filling			
• Discards syringe and transfer device into Sharps® container			