DIAGNOSTIC SERVICES

ALBERTA

YEAR IN REVIEW

JANUARY – DECEMBER 2019

Diagnostic Services “Year in Review” statistics are based on a January to December calendar year. The calendar year provides better correlation with Health Canada birth statistics.

SENIOR STAFF AND CONTACT INFORMATION

Laboratory Medical Director Dr. Judith Hannon, MD, FRCPC	780-431-8714 judy.hannon@blood.ca
Diagnostic Services Manager Lhevinne Ciurcovich, MLT	604-707-3449 lhevinne.ciurcovich@blood.ca
Technical Supervisor Diagnostic Services Gerri Barr, MLT	780-431-8724 gerri.barr@blood.ca
Supervisor, Testing Brenda Caruk, MLT	780-431-8725 brenda.caruk@blood.ca
Supervisor, Genotyping Kirsten Hannaford, MLT	780-431-8705 kirsten.hannaford@blood.ca
Supervisor, Operational Support Taunya Mielke, MLT	780-431-8737 taunya.mielke@blood.ca
Supervisor, Operational Support Tammy Bartok, MLT	780-431-8779 tammy.bartok@blood.ca

Perinatal Laboratory
Phone # 780-431-8759
Fax # 780-431-8747

Reference Laboratory
Phone # 780-431-8765
Fax # 780-431-8779

Laboratory Services Website https://blood.ca/en/hospital-services/laboratory-services

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PERINATAL LABORATORY

The Perinatal Laboratory within Diagnostic Services at Canadian Blood Services provides diagnostic testing of pregnant women for blood type and red blood cell antibodies. Results from this screening assist physicians, midwives and nurse practitioners in ensuring the appropriate management of a pregnancy for both the mother and baby.

A. Testing Performed

Canadian Blood Services Perinatal Laboratory routinely performs the following tests:

- ABO/Rh blood type
- Screen for red blood cell antibodies
- Antibody Identification
- Antibody Titration
- Phenotyping
- Fetal Bleed Screening Test
- Kleihauer-Betke Test for quantitation of fetal-maternal hemorrhage
- Postnatal Testing

B. Testing Frequency

Mothers – Initial Testing: All women should be tested upon their first prenatal visit.

Mothers – 26-28 Weeks Gestation: All Rh negative women should be retested at 26-28 weeks gestation. Rh positive women should also be retested at 26-28 weeks gestation when there is only one blood group result available (usually first pregnancy) or if patient is at increased risk of allo-immunization (e.g. previous transfusion, maternal trauma or obstetrical procedure).

Mothers – Antibody Present: If the antibody is known to cause HDFN, it is recommended that specimens be submitted monthly in the first and second trimester and every two weeks in the last trimester. More frequent testing may be indicated if the antibody titre rises rapidly or if clinical monitoring mandates that additional sampling would provide helpful information. Less frequent sampling may also be recommended for antibodies that are unlikely to be clinically significant or in cases where clinical monitoring through fetal Doppler ultrasound has commenced.

Mothers – Postnatal: Following delivery, specimens from the mother and her baby should be tested if the Rh of the mother is unknown, the mother is Rh negative, the mother has a clinically significant antibody or if the baby shows signs of HDFN (i.e. anemia or jaundice). Midwives or hospitals that do not perform transfusion medicine testing should submit specimens to Canadian Blood Services. A fetal bleed screening test is performed if an Rh negative woman delivers an Rh positive baby. The Kleihauer-Betke assay is performed when the mother has a positive fetal bleed screening test.

Newborns (Cords): Cord blood or neonatal specimens must be submitted with the mother's specimen as noted above. ABO/Rh and direct antiglobulin testing is performed on cord or neonatal specimens submitted to Canadian Blood Services. The direct antiglobulin test is performed if the mother has a clinically significant

antibody or on request if the baby shows signs of HDFN (i.e. anemia or jaundice). This is especially important when the mother is Rh negative or when the mother has a clinically significant antibody. If the baby has unexpected anemia or jaundice assessment of the cord blood sample for blood group and DAT may also be helpful.

Partners: When a woman has an antibody capable of causing HDFN, specimens from the partner will be requested for ABO/Rh and antigen phenotyping. This will assist in assessing the probability of the baby being affected by the antibody. Partners' specimens may also be tested to assess Rh Immune Globulin (RhIG) eligibility of Rh negative mothers.

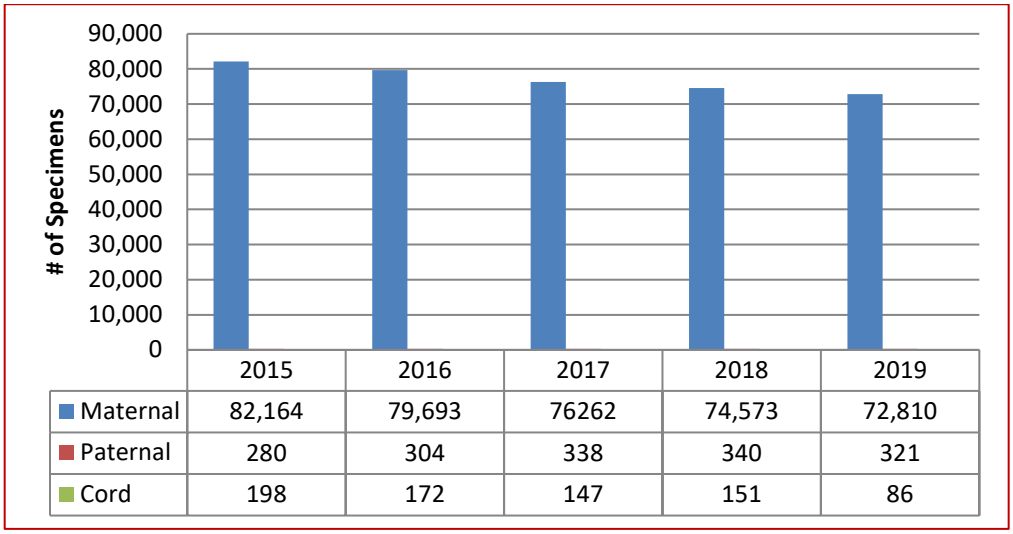
C. Specimens Tested

The data includes all women tested.

Table 1: Perinatal Specimens Tested

Specimen Type	Test Type	2015	2016	2017	2018	2019
Maternal	Type and Screen	82164	79693	76262	74573	72,810
Paternal	ABO/Rh	280	304	338	340	321
Cord	ABO/Rh	198	172	147	151	86
Total # of Specimens Tested		81871	82642	80169	76747	73,217
Total # of Patients Tested		**68657**	**66287**	**63958**	**62221**	**60,639**

Figure 1: Total Perinatal Specimens Tested



Antibodies Identified

In 2019, a total of 381 antibodies were reported (see *Table 2*). This is lower than 2018 where 526 antibodies were reported. Of 381 antibodies identified in 2019, seventy-three (73) women had multiple antibodies. Passive anti-D data has been excluded from the preceding numbers.

Antibodies identified are considered to be clinically significant if they have been reported to cause HDFN. The most common clinically significant antibodies identified were: anti-E, anti-c, anti-D, anti-K, anti-M (IgG), (see *Figure 2*) which together represented 85% of the total antibodies identified. IgG Anti-M can be considered clinically significant as it may cause HDFN and/or delayed neonatal anemia in rare cases.
Titres for 15 of the clinically significant antibodies increased from non-critical to critical levels during the pregnancy with a total of 53 antibody titres at critical levels (see *Table 3*). Recommendations were made for all patients with a critical titre level (current or previous pregnancy) and all Kell system antibodies to be referred to a High-Risk Fetal Assessment Clinic for further follow-up and monitoring during pregnancy.

Table 2: Total Number of Perinatal Antibodies Detected

Maternal Antibodies Identified–2019					
Clinically Significant Antibodies	**2015**	**2016**	**2017**	**2018**	**2019**
Anti-D	49	58	56	48	53
Anti-C	17	13	20	26	6
Anti-Cw	2	1	0	0	0
Anti-Ce	0	0	0	0	0
Anti-c	41	43	43	65	29
Anti-E	91	106	108	150	135
Anti-e	13	6	10	4	7
Anti-f	0	0	0	0	0
Anti-G	3	1	6	6	2
Anti-K	46	53	59	70	52
Anti-M*	37	29	40	52	38
Anti-S	14	7	11	13	4
Anti-s	3	1	1	0	2
Anti-U	1	0	0	2	1
Anti-Fya	18	12	18	12	4
Anti-Fyb	2	0	1	3	1
Anti-Jka	34	18	30	28	20
Anti-Jkb	4	1	2	4	3
Anti-JK3	1	0	0	0	0
Anti-Lua	0	2	0	2	1
Anti-Lub	1	1	0	2	1
Anti-V	0	0	0	0	0

Maternal Antibodies Identified–2019					
Anti-Vw	0	0	0	0	0
Anti-Dia	1	0	0	0	1
Anti-Kpa	1	0	0	2	0
Anti-Wra	2	5	2	5	1
Anti-Jsa	0	0	1	0	0
Anti-Mia	0	0	2	1	1
Anti-Joa	0	0	0	1	0
Anti-Yta	0	0	0	2	1
Anti-Mur	0	0	0	1	0
Anti-PP1Pk	0	0	0	1	0
Anti-Sc2	0	0	0	0	1
Total	**381**	**357**	**410**	**500**	**364**

*Anti-M – IgG antibody detected

Clinically Insignificant Antibodies	**2015**	**2016**	**2017**	**2018**	**2019**
Anti-A1					10
Anti-Lea	6	8	12	20	11
Anti-Leb	1	1	1	3	3
Anti-N	1	1	2	1	2
Anti-P1	3	0	1	2	1
Anti-VS	0	1	0	0	0
Passive Anti-D (not included in total)	633	497	680	555	855
TOTAL: Clinically Insignificant Antibodies	**11**	**11**	**16**	**26**	**17**

Table 3: Perinatal Patient Antibody Titres 2019

Antibody	Critical Level	Non-Critical Level	Non-Critical to Critical
Anti-C		9	
Anti-c	4	25	
Anti-Ce		1	
Anti-Cw		1	
*Anti-D	15	33	5
Anti-D/C/G		1	
Anti-DC	3	1	
Anti-DE	1		
Anti-DG		1	
Anti-Dia	1		
Anti-E	18	109	7
Anti-e	1	6	1
Anti-Ec	1	10	1
Anti-Fya	1	4	
Anti-Fyb		2	
Anti-G		2	
Anti-Jka	2	25	1
Anti-Jkb		4	
Anti-Joa			
Anti-K		2	
Anti-Kpa	1		
Anti-Lua		1	
Anti-M	1	35	
Anti-Mia &/or Mur		1	
Anti-S		8	
Anti-s		1	
Anti-U		1	
Anti-Wra	4	3	1
Rh Antibody		2	

* There are 15 critical + 33 non-critical anti-D for a total of 48, which is less than the 53 listed, as antibodies are not titred if they reached a critical titre in a previous sample or pregnancy.

Figure 2: Total Number of Perinatal Antibodies

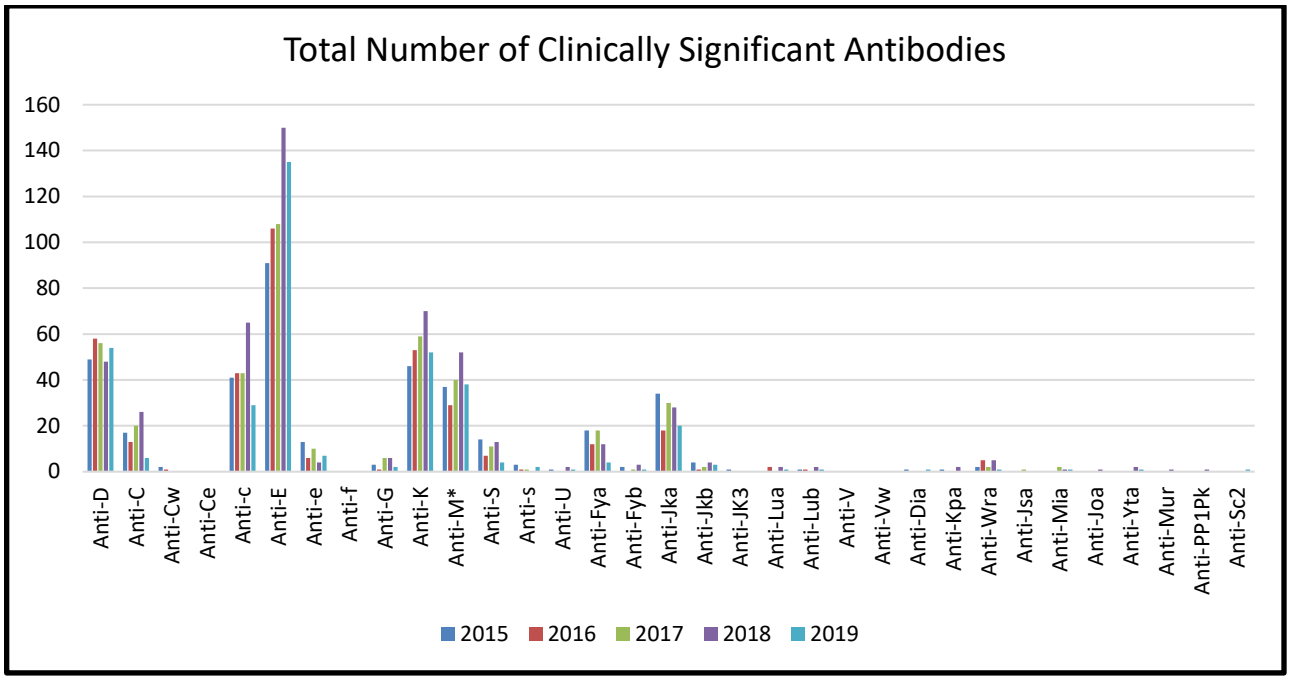


Figure 3: Frequency of Clinically Significant Antibodies 2019

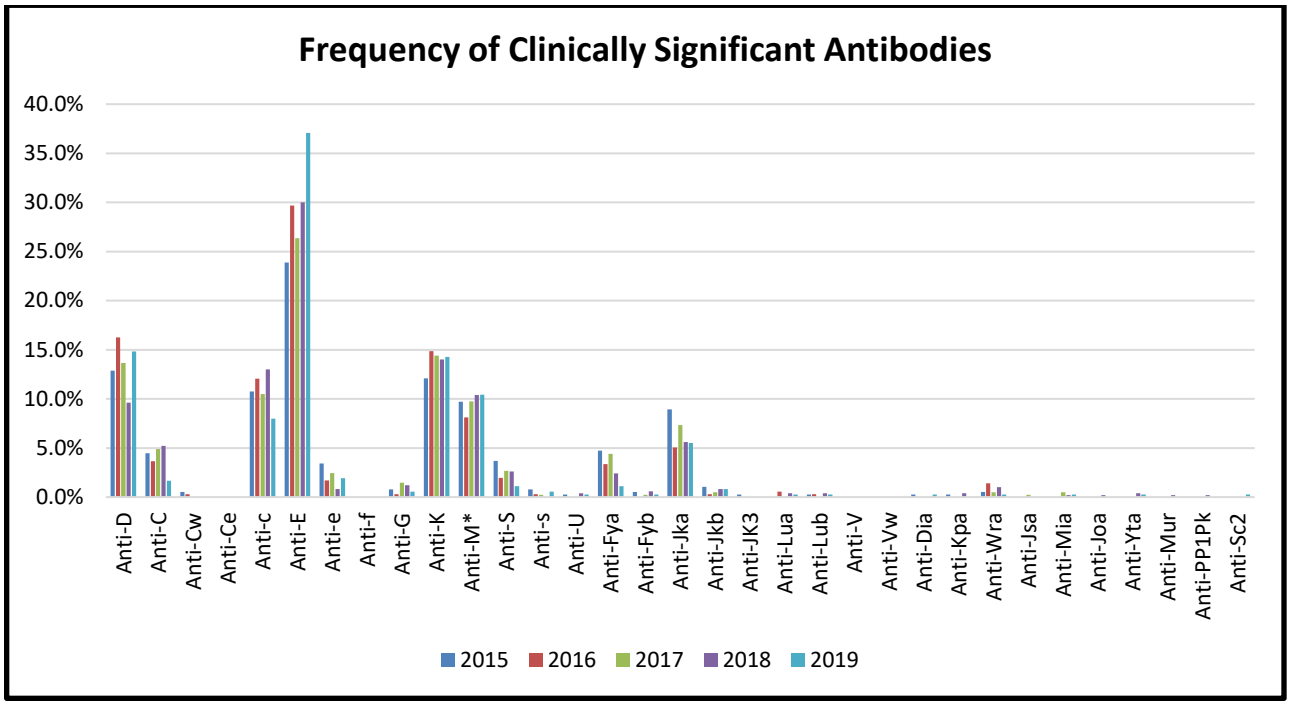


Table 4: Perinatal Combination Antibodies 2019

Combination Antibodies	Number
Anti-c Anti-Fya Anti-Jkb	1
Anti-C Anti-Fyb Anti-Jka Anti-Mta Unidentified Antibody	1
Anti-c Anti-K	1
Anti-c Anti-K Unidentified Antibody	1
Anti-c Anti-Lea Unidentified Antibody	1
Anti-C Anti-S	1
Anti-C Autoantibody Unidentified Antibody	1
Anti-C Panreactive Autoantibody	1
Anti-C Unidentified Antibody	1
Anti-D Anti-C	6
Anti-D Anti-C Anti-Jka	1
Anti-D Anti-E	2
Anti-D Anti-G	1
Anti-E Cold Agglutinin Unidentified Antibody	1
Anti-E Anti-c	11
Anti-E Anti-c Anti-Cw Anti-Lea Anti-Leb Unidentified Antibody	1
Anti-E Anti-c Anti-Jka	1
Anti-E Anti-c Anti-Wra	2
Anti-E Anti-c Anti-Wra Unidentified Antibody	1
Anti-E Anti-Fya	2
Anti-E Anti-K	3
Anti-E Anti-K Unidentified Antibody	2
Anti-E Anti-Lea	2
Anti-E Anti-S	1
Anti-E Anti-S Anti-Jka Unidentified Antibody	1
Anti-e Panreactive Autoantibody	1
Anti-E Unidentified Antibody	4
Anti-e Unidentified Antibody	1
Anti-Fyb Anti-Jka	1
Anti-Jka Anti-Wra	1
Anti-K Anti-Lea	1
Anti-K Anti-Jka	2
Anti-K Anti-Kpa Unidentified Antibody	1
Anti-K Unidentified Antibody	1
Anti-Lea Anti-Leb	1

Combination Antibodies	Number
Anti-Mia Anti-Mur	1
Anti-N Anti-S	1
Anti-N Cold Agglutinin	1
Anti-S Anti-Wra Autoantibody Unidentified Antibody	1
Anti-S Panreactive Autoantibody	1
Anti-s Unidentified Antibody	1
Anti-Sc1 Unidentified Antibody	1
Anti-Wra Unidentified Antibody	1
Anti-Yta Unidentified Antibody	1
Cold Agglutinin Unidentified Antibody	1
Panreactive Autoantibody Cold Agglutinin	3
Panreactive Autoantibody Unidentified Antibody	1
Total	75

REFERENCE LABORATORY

The Reference Laboratory, Edmonton Diagnostic Services provides testing for hospital transfusion medicine laboratories. Hospital patients who are repeatedly transfused may develop red cell antibodies and as a result may have difficulty in tolerating transfusions. Diagnostic Services has specialized and experienced technologists that assist and provide consultation to hospital transfusion medicine laboratories. The Reference Laboratory identifies red cell antibodies, blood group discrepancy resolution, direct antiglobulin testing, fetal bleed screening and other serological testing.

Staff within our department may collaborate with other references laboratories such as the National Immunohematology Reference laboratory (NIRL).

Diagnostic Services Red Cell Antibody Investigations

In 2019, hospitals have referred 337 requests for red cell antibody identification.

Diagnostic Services provides support to hospitals in Alberta, Northwest Territories, northeastern British Columbia and Lloydminster, Saskatchewan. Referring hospitals have different capabilities and expertise in resolving red cell antibody investigations. Some hospitals have limited reagents for antibody identification or phenotyping of patient or donor units. Others have access to a wider variety of reagent red cell panels and methods as well as on site immunohematology expertise. A few hospital transfusion medicine laboratories have the resources to resolve the majority of serological problems and send only complex investigations for additional serological or genotyping studies.

Canadian Blood Services, Diagnostic Services provides consultation and testing support including antibody investigation, advanced or alternative techniques where required, and recommendations for compatibility testing methods and selection of appropriate donor unit phenotypes if necessary.

Reporting may include interim, final and supplemental reports, depending on the urgency of the testing, the need for patient transfusion and the complexity of the investigation. When a new antibody is identified by the Diagnostic Services Laboratory, a patient wallet card may be provided.

A. Testing Performed

The Reference Laboratory routinely performs the following tests:

- ABO/Rh blood type
- Screen for red blood cell antibodies
- Antibody Identification, if antibodies are detected
- Phenotyping
- Direct Antiglobulin Test
- Elution and Adsorption
- Cold Agglutinin Screen

Antibody Screening is routinely performed by solid phase testing. Combinations of solid phase testing and indirect antiglobulin tube testing using PEG for enhancement are the primary antibody identification methods. PEG IAT is also the manual back-up method for antibody screening.

As a Reference Laboratory, the laboratory performs complex antibody investigations.

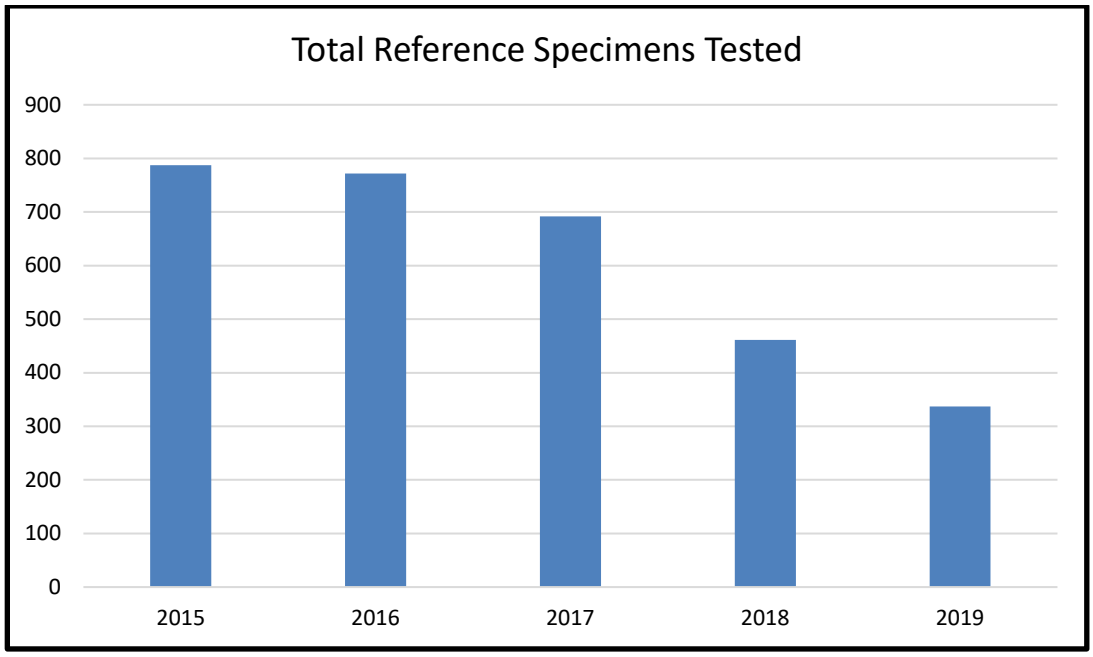
B. **Specimens Tested**

The data in this report reflects a calendar year period to enable better correlation to other government statistical data (Statistics Canada birth statistics).

Table 5: Reference Specimens Tested

Specimen Type	2015	2016	2017	2018	2019
Total Reference Antibody Investigations	787	772	692	461	337

Figure 4: Total Reference Specimens Tested



C. Antibodies Identified

In 2019, a total of 148 antibodies were reported (see *Table 6*). The total number of antibodies detected is lower than in 2018, but the distribution of the most common antibodies remains consistent. Two hundred and five (205) patients had antibodies identified, and of these, thirty-eight (38) patients had multiple antibodies.

Antibodies identified are considered to be clinically significant if they have been reported to cause acute or delayed hemolytic transfusion reactions. The most common clinically significant antibodies identified were anti-D, anti-C, anti-E, anti-K and anti-Jk[a] (see *Figure 5*) which together represented 47% of the total antibodies identified.

Table 6: Total Number of Reference Antibodies Detected

Reference Antibodies Identified– *Prior to 2019 numbers included Crossmatch samples.					
Antibodies	**2015**	**2016**	**2017**	**2018**	**2019**
Anti-D	16	31	15	14	8
Anti-C	8	19	10	11	4
Anti-Cw	7	1	2	1	2
Anti-Ce	0	0	0	0	0
Anti-c	15	9	8	10	2
Anti-E	52	65	57	52	25
Anti-e	7	7	5	5	4
Anti-K	48	54	44	47	24
Anti-k	1	1	0	0	0
Anti-M	4	9	18	8	9
Anti-N	0	0	0	0	0
Anti-S	6	3	8	6	1
Anti-s	0	0	0	0	2
Anti-Fya	16	10	16	9	3
Anti-Fyb	1	1	1	1	0
Anti-Jka	18	13	16	12	9
Anti-Jkb	4	3	2	2	0
Anti-Lea	8	8	3	2	2
Anti-Leb	1	0	0	0	0
Anti-Lua	1	1	1	0	0
Anti-Lub	0	1	0	0	0
Anti-Jsa	0	0	0	0	0
Anti-Dia	0	0	0	0	0
Anti-Fy3	0	0	0	1	0
Anti-Kpa	3	1	1	3	1

Reference Antibodies Identified– *Prior to 2019 numbers included Crossmatch samples.					
Anti-Wra	1	1	2	0	2
Anti-A1	2	2	2	1	0
Anti-P1	0	1	0	1	0
Anti-Cob	0	0	0	0	0
Anti Yta	0	0	1	0	0
Anti-IH	0	0	0	0	1
Anti-JMH	0	0	0	0	1
Panreactive Autoantibody*	*	*	*	*	16
Unidentified Antibody*	*	*	*	*	6
Cold Agglutinin*	*	*	*	*	20
Autoantibody*	*	*	*	*	1
Panreactive Antibody*	*	*	*	*	5
Total	**219**	**241**	**212**	**186**	**148**

*Not counted in previous years

Figure 5: Total Number of Reference Antibodies

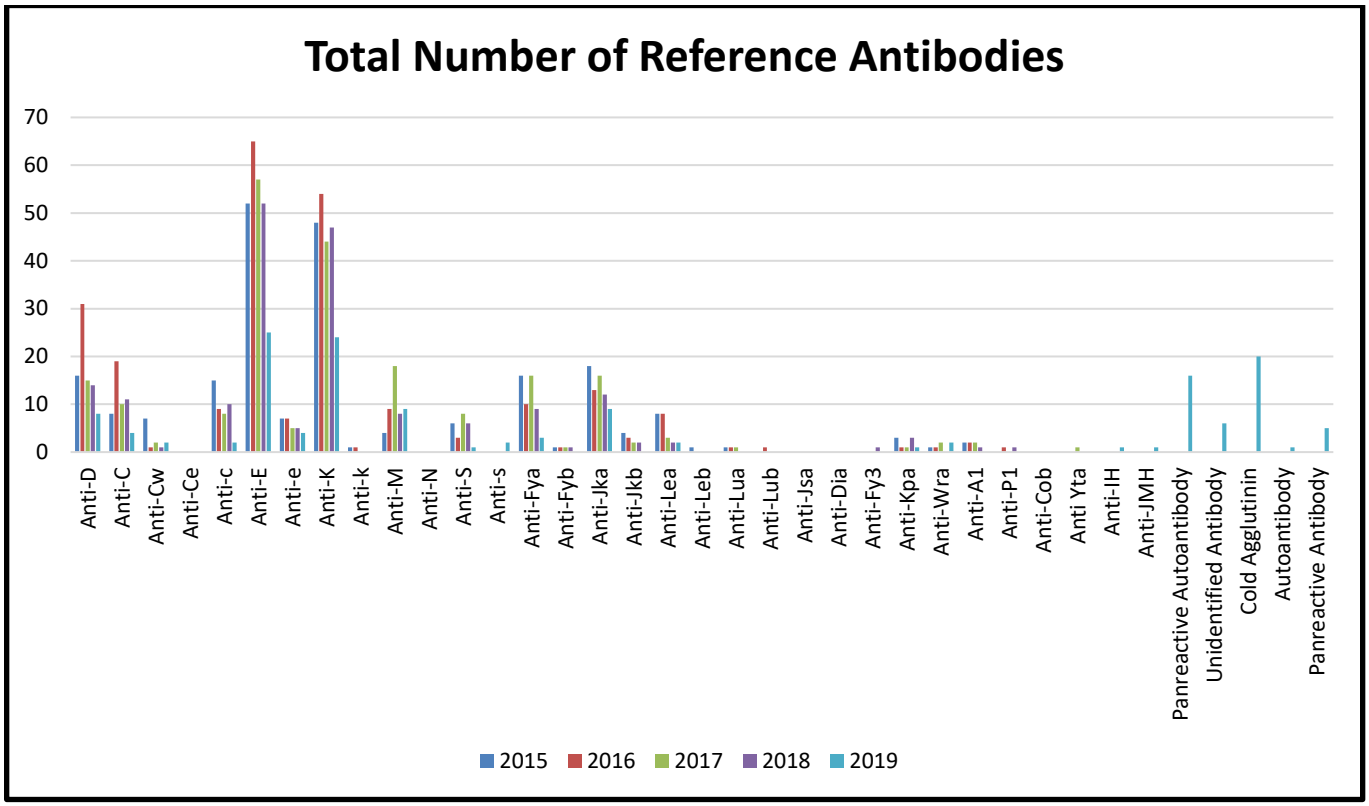
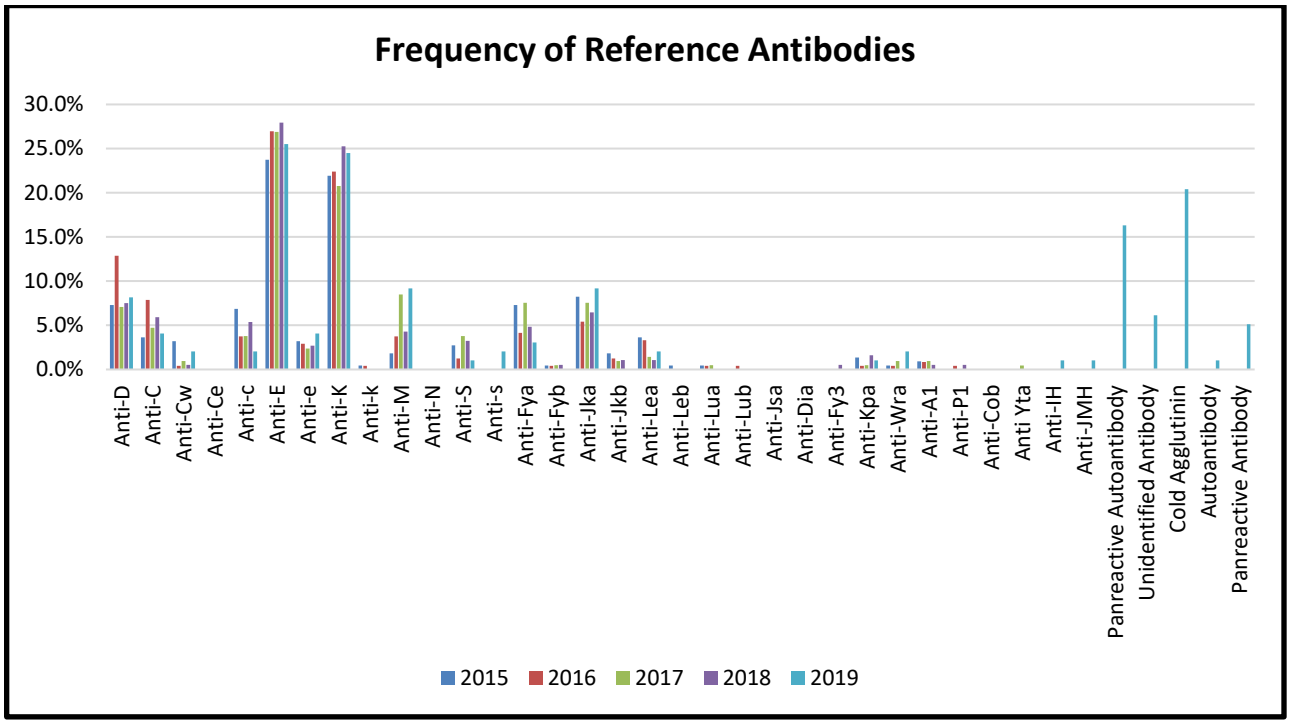


Figure 5a: Frequency of Reference Antibodies



FETAL GENOTYPING

Canadian Blood Services in Alberta refers specimens for fetal genotyping on maternal plasma to the International Blood Group Reference Laboratory (IBGRL) of the National Health Services (NHS) in Bristol, United Kingdom. Amniotic fluid samples are rarely sent to the Versiti (formerly Blood Center of Wisconsin) for fetal genotyping. Testing on maternal blood samples is preferred because sample collection does not represent a risk to the fetus.

Specimens are submitted through the Maternal Fetal Medicine clinics in Edmonton or Calgary and are accepted if they meet the following criteria:

- The mother has an antibody capable of causing hemolytic disease of the fetus/newborn (HDFN), AND
- The father is heterozygous for the corresponding antigen (or unknown), AND
- The antibody titre has reached a critical level, OR
- There has been a previous fetus/newborn affected by HDFN, OR
- The antibody is anti-K, OR
- Amniocentesis is being performed for another indication (ie advanced maternal age), even if the mother's antibody titre is at a non-critical level.

Discussion with a Canadian Blood Services physician is required prior to submitting specimens for testing outside of these criteria.

The number of specimens referred for fetal genotyping has ranged between 18 and 24 specimens in recent years.

Table 7: Fetal Genotyping Results Summary

	2015	2016	2017	2018	2019
Total samples sent	20	23	24	26	31
# of patients tested	17	22	24	21	28
# of patients not requiring MFM follow-up. (Fetus tested negative for the corresponding antigen)	4	9	5	12	8

Table 8: Fetal Genotyping Results Summary 2019

Patient	Maternal Antibody	Predicted Fetal Phenotype	Follow-up Required
1	Anti-K	K Pos	Yes
2	Anti-D, C	RhD Pos (C not tested)	Yes
3	Anti-D, E	RhD Neg & RhE neg	No
4	Anti-D	RhD Pos	Yes
5	Anti-c	Rhc Pos	Yes
6	Anti-E	RhE Pos	Yes
7	Anti-E, Wra	RhE Pos	Yes
8	Anti-E	RhE Neg	No
9	Anti-D	RhD Pos	Yes
10	Anti-K	K neg	No
11	Anti-E	RhE neg	No
12	Anti-E	RhE Pos	Yes
13	Anti-D	RhD Pos	Yes
14	Anti- D	RhD Pos	Yes
15	Anti-D, E	RhD Pos & RhE pos	Yes
16	Anti-K	K neg	No
17	Anti-K, E	K neg & RhE Pos	Yes
18	Anti-D, E	RhD neg & RhE neg	No
19	Anti-D	RhD Pos	Yes
20	Anti-E	RhE Pos	Yes
21	Anti–E	RhE Pos	Yes
22	Anti-C, e	RhC Pos (e not tested)	Yes
23	Anti-D	RhD Pos	Yes
24	Anti- D	RhD neg	No
25	Anti-D	RhD Pos	Yes
26	Anti-K	K neg	No
27	Anti-E	E Inconclusive	Yes
28	Anti-E	RhE Pos	Yes

RHD RED CELL GENOTYPING

Canadian Blood Services in Alberta provides RHD red cell genotyping for facilities in cases where the predicted RhD status of a patient cannot be determined due to discrepant, weak or inconclusive serological RhD testing. The following 2019 testing algorithm was used within Canadian Blood Services laboratories to determine which samples require RHD genotyping.

Figure 6: RhD Testing Algorithm

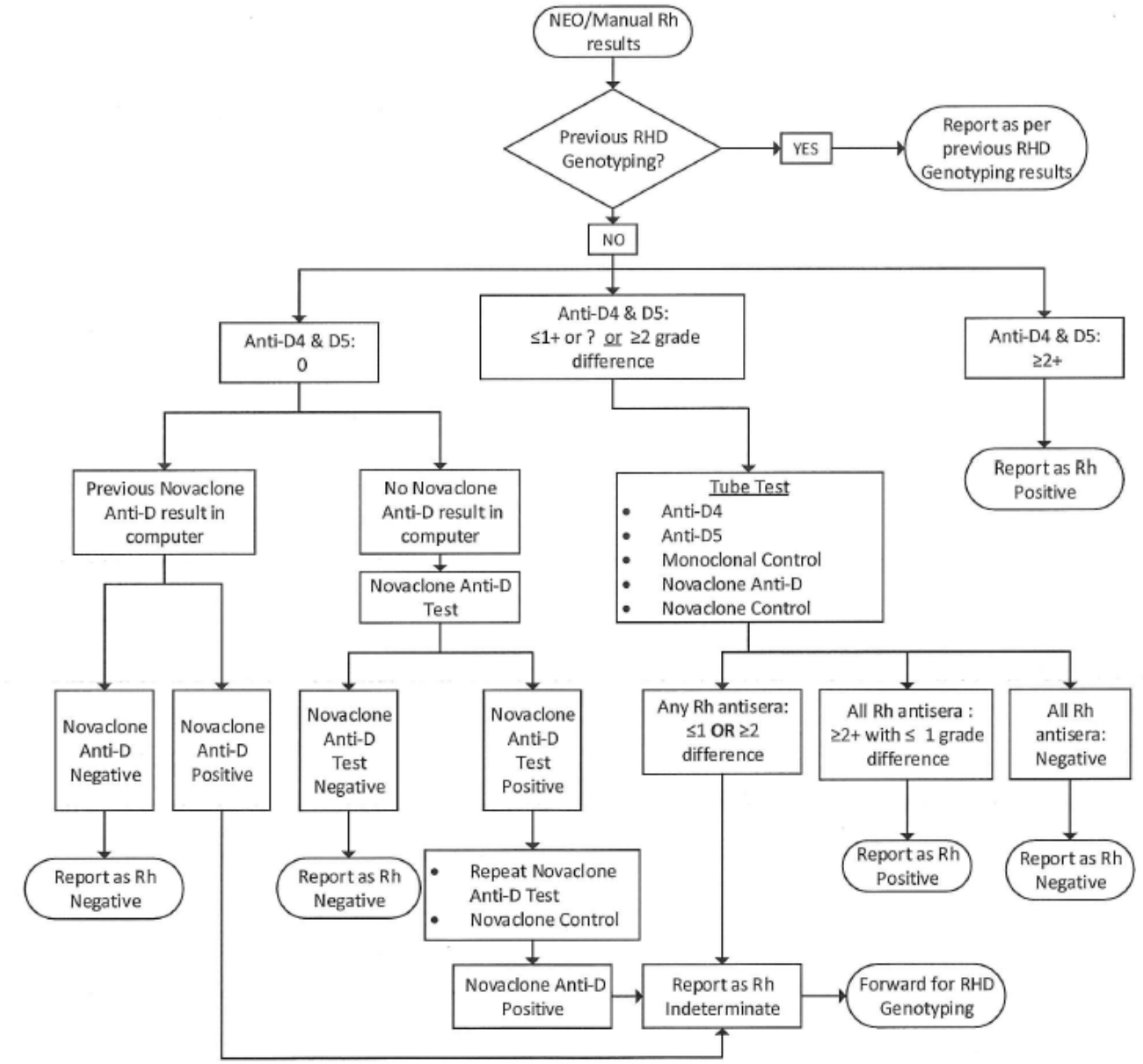


Table 9: Patient # - RHD Type/Result 2019

2019 RHD Genotyping Results	
RHD Variant	**Number Identified**
Weak D type 1	236
DAR	49
DAR/DAU5 or DV type 1 or DBS2	1
DAR/DIIIa-CE(4-7)-D	4
DAR/Weak D type 4.0 or 4.3	4
DAR/Weak D type 4.1	1
DAU1	1
DAU2	6
DAU3	2
DAU3/DIIIa-CE(4-7)-D	1
DAU4 or DV type 5	4
DAU5 or DV type 1 or DBS2	1
DCS1 or DFV	2
DFR or DFR3	2
DFR2	1
DHMi	5
DIII type 4/DV type 2 or DBS1 or DV type 7	1
DIIIa	1
DIIIa or DIIIa/DIIIa-CE(4-7)-D	4
DIIIa-CE(4-7)-D	1
DIV type 5 or DIVb/DIIIa-CE(4-7)-D	2
DIVa type 2 or DIVa type 2/DIIIa-CE(4-7)-D	1
DIVa type 2/DAU3	1
DIVa type 2/RHD psi	1
DNB	1
DOL or DOL2	8
DUC2	1
DVI	3
IC	3
IC	1
Possible D	288
Possible D (with AB call)	1
Possible D (with LS*)	2
Possible D/DAR	2
Possible D/DAU3	1

2019 RHD Genotyping Results	
RHD Variant	**Number Identified**
Possible D/DAU5 or DV type 1 or DBS2	2
Possible D/DFR or DFR3	1
Possible D/DIIIa	9
Possible D/DIIIa-CE(4-7)-D	10
Possible D/DIVa Type 2	5
Possible D/DOL or DOL2	1
Possible D/DV type 2 or DBS1 or DV type 7	1
Possible D/RDH psi	1
Possible D/RHD psi	1
Possible D/Weak D type 1	1
Possible D/Weak D type 15	1
Possible D/Weak D type 4.0 or 4.3	3
RHD Deletion	46
RHD psi	2
RHD psi/DAR	1
RHD psi/DAU5 or DV type 1 or DBS2	1
RHD psi/weak D type 4.0 or 4.3	3
Weak D type 1/weak D type 3	2
Weak D type 1/Weak D Type 4.0 or 4.3	1
Weak D type 11	1
Weak D type 2	120
Weak D type 3	51
Weak D type 3/RHD psi	1
Weak D type 4.0 or 4.3	56
Weak D type 4.0 or 4.3/DIIIa or DIIIa-CE(4-7)-D	12
Weak D type 4.1	1
Weak D Type 4.1/DAU2	1
Weak D type 5	4
Total	982

The array used for RHD genotyping (Immucor's BioArray BeadChip™ Molecular Assay) is extensive and can detect the most common mutations of the *RHD* gene. The most common variants detected are weak D type 1, weak D type 2 and weak D type 3. Individuals with these phenotypes can be safely treated as Rh positive as it has been established that they will not form alloanti-D. Patients with any other weak or partial D phenotypes may be capable of forming alloanti-D and should be treated as Rh negative. When none of the variants present on the array are detected, the software will produce a result of "Possible D". Prior to 2018, it was decided to err on the side of caution, and Canadian Blood Services recommended that patients with a result of "Possible D" be treated as Rh negative. However, based on clinical experience and sequencing studies, it has been confirmed that the vast majority of these patients do not have a mutation of the *RHD* gene. In 2018 the reporting was changed to reflect this and patients with results of "Possible D" were reported as Rh positive individuals.

Table 10: RHD Genotyping – Number of Rh Negative and Rh Positive Predicted Phenotypes

	2015	2016	2017	2018	2019
Rh Positive	200	292	309	581	702
Rh Negative	175	338	390	153	280
Total # samples tested	375	630	699	734	982

QUALITY INDICATORS

The laboratories monitor many quality indicators and the two which are most relevant to this document are turnaround times and rejected specimens which are presented below.

A. Turnaround Times

To ensure timely reporting of patient test results, Canadian Blood Services monitors turnaround time (TAT) from when specimens are received at Canadian Blood Services in Edmonton to the time when the results are available. Since monitoring of this quality indicator began in 2008, the percentage of perinatal specimens has been close to the predefined TAT threshold. The percentage of reference specimens has consistently met the predefined TAT threshold. Samples whose testing failed to meet expected TATs are usually those where clinically significant antibodies are detected or where difficulty in finding compatible blood is encountered.

Table 11: Turnaround Time – Routine Criteria by Specimen Type

Specimen Type	Expected Turnaround Time	Expected % of Specimens Which Meet or Exceed Expected TAT
Routine Perinatal	72 hours	85%
Reference Testing	72 hours	85%

Table 12: Turnaround Time – Perinatal Routine TAT

Turnaround Time (TAT)	2015	2016	2017	2018	2019
% of Specimens Tested within 72 hours	85%	84%	77%	88%	85%
% of Specimens Tested > 72 hours	15%	16%	23%	12%	15%

Figure 7: Perinatal Routine TAT

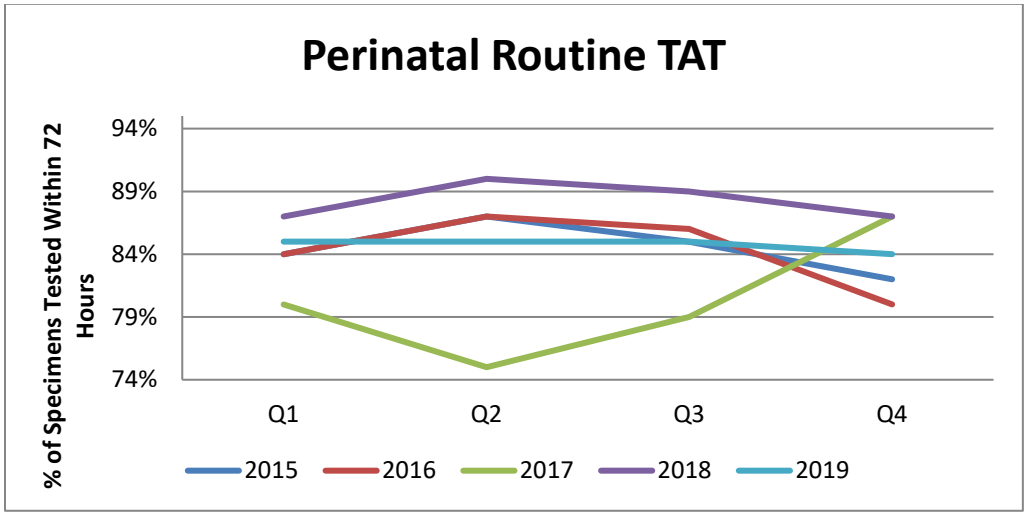
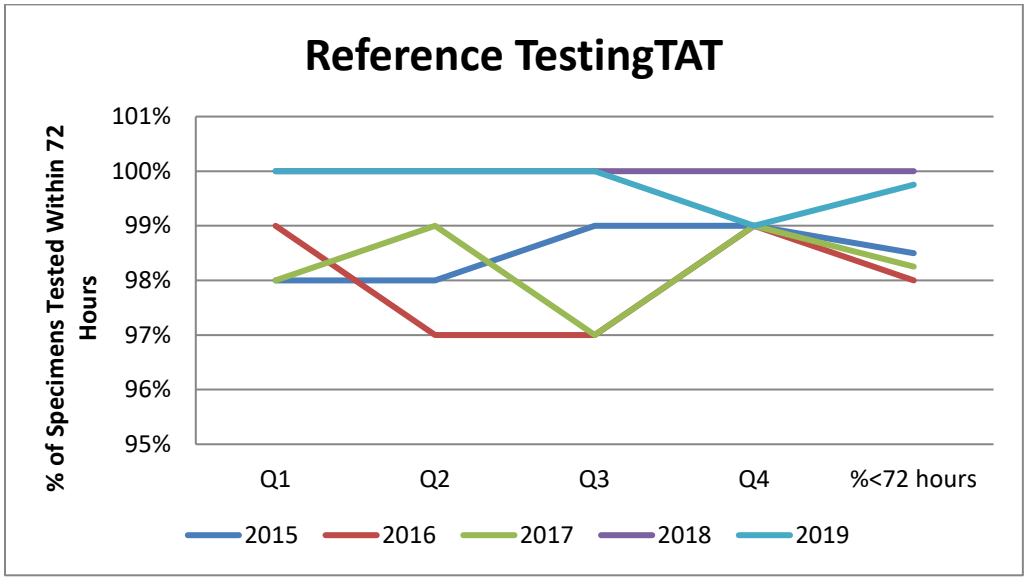


Table 13: Turnaround Time – Reference Specimens

Turnaround Time (TAT)	2015	2016	2017	2018	2019
% of Specimens Tested within 72 hours	98%	98%	99%	100%	100%
% of Specimens Tested > 72 hours	2%	2%	1%	0%	0%

Figure 8: Reference TAT



B. Rejected Specimens

Each time a specimen is rejected, a reason for rejection is entered into our Laboratory Information System. This data is then retrieved and analysed on a quarterly basis for both reference samples which are coming from hospitals and for perinatal samples which are primarily collected at community collection sites. The Diagnostic Services Laboratory is following the provincial specimen rejection guidelines for Alberta.

The reasons for rejecting specimens in the reference and the perinatal laboratories are somewhat different.

For perinatal specimens, the most common reasons for rejecting a sample for testing are patient identification labelling errors and duplicate requests for testing (duplicate specimens). Testing requests are rejected if another sample from the patient was tested within the previous 96 hours. Often a duplicate test request sample is collected when the patient has seen their family physician and then sees their obstetrician shortly after. We do ensure that the report from the initial testing is sent to the second physician making the request. Health care professionals can access Canadian Blood Services reports for Alberta patients on Netcare, Alberta's Electronic Health Record.

Table 14: Quarterly Rejection Rates – Perinatal Specimens 2019

Rejection Category	Q1	Q2	Q3	Q4
Requisition	20	18	14	28
Specimen	42	55	130	48
Discrepancies Between Requisition & Specimen	10	15	13	17
Discrepancies Between Current Requisition & Historical Records	0	0	0	0
Other (Duplicates, etc.)	12	5	18	1
Total # specimens rejected	84	93	175	94
Total # specimens received	18369	17920	18607	17651
Rejections as a % of total	0.5%	0.5%	0.9%	0.5%

Figure 9: Perinatal Rejection Reasons 2019

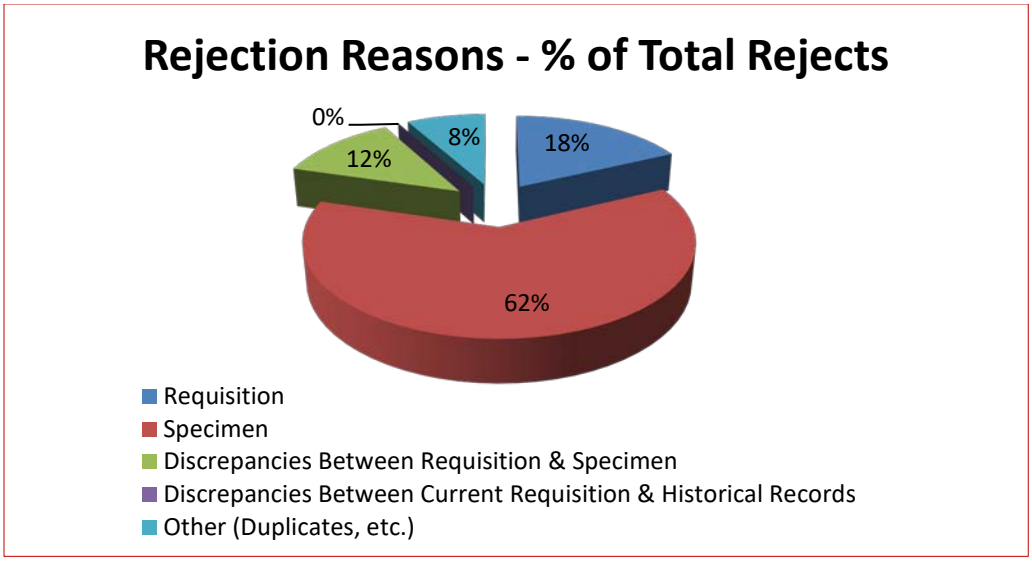
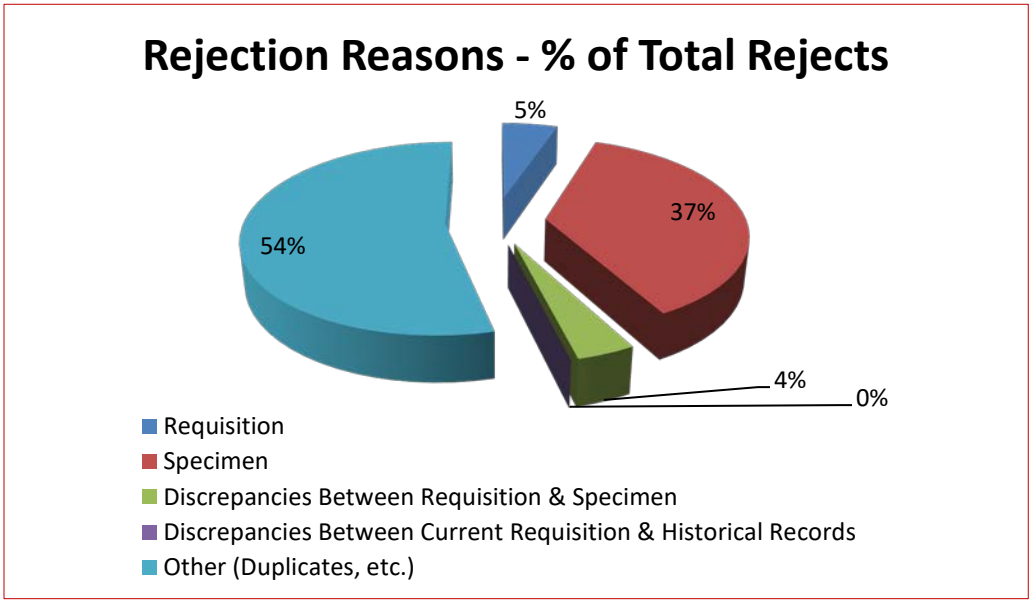


Table 15: Quarterly Rejection Rates – Reference 2019

Rejection Category	Q1	Q2	Q3	Q4
Requisition	2	1	0	1
Specimen	7	7	7	7
Discrepancies Between Requisition & Specimen	0	1	1	1
Discrepancies Between Current Requisition & Historical Records	0	0	0	0
Other (Duplicates, etc.)	9	4	19	9
Total # specimens rejected	18	13	27	18
Total # specimens received	405	314	392	434
Rejections as a % of total	4.4%	4.1%	6.9%	4.1%

Figure 10: Reference Rejection Reasons 2019



DIAGNOSTIC SERVICES UPDATES 2019

Updates pertain to all Diagnostic Services sites within Canadian Blood Services: Vancouver, Edmonton, Winnipeg and Brampton

ALL CBS Diagnostic Services Sites	**Implementation of eTraceline Nov 2019**: eTraceline was implemented at all CBS reference laboratory sites in November 2019.
	Implementation of Antigen Plus April 2019 Antigen Plus, a program to allow development of panels from reagent cell collections was implemented along with a review and re organization of the reference lab inventory of rare reagent red cells and antisera.
	Perinatal Advisory Committee The PNAC continues to collaborate throughout the year and at an annual November meeting. The group reviewed and discussed an ongoing project related to the titration of multiple antibodies using cells with both antigens represented versus the standard method involving separate titrations of each antibody. An update of the plans for repatriation of Saskatchewan patient samples to a provincial hospital-based program was provided and a collaborative study to compare titer levels using the Saline IAT method at CBS vs the automated gel titration method in the Saskatchewan perinatal program was discussed. A review of the form used for notification of Intra uterine transfusion by the BC maternal fetal medicine group was provided Results of the recent Canada wide survey distributed to perinatal testing labs by the Canadian Obstetrical Perinatal network were reviewed and discussed. A project in the Manitoba Red Cell Serology lab involving development of a new process for preparing aliquots of red cell units for neonatal transfusion was described. New interpretive reporting comments for specimens with features suggesting Fetal /neonatal Alloimmune thrombocytopenia were discussed.

ALL CBS Diagnostic Services Sites	**DBL Novaclone Testing (NCT) on all Rh Negative Perinatal Patients Implemented 2019-01-29** CBS DS sites incorporated NCT testing into their prenatal RhD algorithm for all patients who test RhD negative on the NEO analyzer. NCT testing identifies a group of Rh prenatal patients not eligible for RhIG, who might have been typed as Rh negative based on initial NEO testing and results in a decrease in unnecessary RhIG prophylaxis.
	Critical Anti-M titre – Implemented 2019-11-04 Dithiothreitol (DTT) plasma treatment for critical anti-M titres was implemented at all Diagnostic Services Sites to determine if critical titre is due to IgG or IgM:2019-11-04 DTT is used to inhibit IgM antibody activity which allows for detection of underlying IgG antibodies. Procedure is performed on prenatal patients with a critical anti-M titre ($\geq$ 16) to determine the immunoglobulin class and the risk of HDFN. If the antibody is predominately IgG there is greater risk of HDFN and the mother is referred to the Maternal Fetal Medicine Clinic if the titre remains at $\geq$ 16 after the DTT plasma treatment.
Brampton	**Patient Genotype Testing Implemented 2019:** Reference lab testing of patients' samples for genotyping using the Grifols Progenika Core XT platform was implemented in the CBS Brampton reference laboratory in 2019.
	Transition of National Immunohematology Reference laboratory from Ottawa to Brampton site: The NIRL moved location from Ottawa to CBS Brampton
Vancouver /Edmonton	**Ortho MTS Gel Workstation and Pipettes Implemented 2019** Ortho MTS Gel workstations were implemented in the Vancouver and Edmonton Diagnostic Services Laboratories as a supplementary method to help complete antibody cases referred in from hospitals.
	Passive Anti-D Testing by NEO Cap-R Ready ID Implemented 2019-01-29 Vancouver and Edmonton Diagnostic Services Laboratories modified their Passive Anti-D testing platform from manual PEGIAT method to automated Capture R testing using the NEO analyzer. Automated testing provides a reduction in cost and decreased time to complete passive anti-D identification (which represents > 40% of perinatal antibody investigations), positive sample ID and reduces the risk of transcription errors.
Winnipeg	Collaboration with Shared Health Diagnostics to ensure the Diagnostic Services Business Continuity plan meshes seamlessly with other plans was a focus in 2019.

Winnipeg	**College of American Pathologists (CAP) Laboratory Accreditation** An on-site inspection of the Platelet Immunology Laboratory occurred with the lab successfully being granted accreditation. in the beginning of 2019.
	LEAN Continuous Improvement of Red Cell Serology Laboratories – Staff Cross Training Cross-training of staff to perform both pre-transfusion and perinatal testing continued in 2019. The goal is to more efficiently use people's talents.
	Preparation of Red Cell Aliquots for Neonatal and Pediatric Transfusion The project team for aliquoting smaller, patient appropriate doses of red cells for neonate and pediatric transfusion worked in 2019. The process was implemented on January 27, 2020.
	Process Change for the Distribution of Components in eTraceline In collaboration with Shared Health Diagnostics, the process for distribution of blood components to eTraceline facilities changed from using the Reserve/Transfer function to the Reserve/Issue function. This change was implemented on September 16, 2020. This change is a quality improvement initiative to reduce distribution errors by utilizing the broader functionality of the Issue program

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Presentations / Abstracts / Publications Listing
D Lane, R Fallis, B Herdman, A Kabani, C Musuka, L Grabner. **Implementation of Electronic Solution to Reduce the Risk of Mistransfusion in a Regional Transfusion Service,** Poster/Abstract presented at AABB Meeting, San Diego, October 2017.
*Tammy Ison, Balkar Gill, Gwen Clarke, Carmela Pote, Melba Sarmiento***. Rare Donors Identified through Selective Genotype Testing using Voluntary Ethnic Donor Information,** CSTM abstract.
*L. Ciurcovich, H. Abukhadra, T. Dolnik, B. Gill, I. Resz, M. Yan, G. Clarke***. Maintaining an Inventory of Rare Reagent Red Cells and Antisera Across Multiple Reference Laboratories at Canadian Blood Services,** Poster Presentation at CSTM (Canadian Society for Transfusion Medicine), Calgary, Alberta, May 30 – June 2, 2019.
Heba Abukhadra – Supervisor, BCY Diagnostic Services. **Transfusion Medicine Case Studies,** PBCO/CBS Education Session on Blood Transfusion Issues, October 3, 2019.
Kirsten Hannaford, Supervisor EDM Diagnostic Services. **Monocyte Monolayer Assay Implementation**, Presentation for Immunohematology Working Group, May 07, 2019.
Hannon JL, Berardi P, Hannaford K. **Significance of "Possible D" Variant on BioArray BeadChip™ RHD Genotyping of Prenatal Patients, Abstract for** AABB, San Antonio, TX, October 19 – 22, 2019.

Presentations / Abstracts / Publications Listing
K Hannaford, M Yan, L Ciurcovich, J Hannon, G Clarke. **RHD Genotyping of patients with serological weak D: 2444 Patient samples with no anti D on follow up of 428 with a variant RHD,** Abstract for AABB, San Antonio, TX, October 19 – 22, 2019.
Matthew Yan, Medical Officer, CBS BC & Yukon Centre. **Anti-M: A Case of Hemolytic Disease of the Fetus and an Approach to Prenatal Management**, Abstract, Presentation at CSTM, Calgary, Alberta May 30 – June 2, 2019.
Vivian Stephens, Supervisor BCY Diagnostic Services. **Is it You?,** Lunch N Learn Presentation, June 11, 2019.
Brenda Caruk (Supervisor, EDM Diagnostic Services) and Lhevinne Ciurcovich (Technical Supervisor, BCY Diagnostic Services). **DARA and more... a Transfusion Medicine Case Study,** Lunch N Learn Presentation (EDM / BCY CBS Centres) April 3, 2019.