DIAGNOSTIC SERVICES

British Columbia / Yukon

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.

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TABLE OF CONTENTS

SENIOR STAFF AND CONTACT INFORMATION 2

TABLE OF CONTENTS 3

FIGURES 4

TABLES 4

PERINATAL LABORATORY 5

A. Testing Performed 5

B. Testing Frequency 5

C. Specimens Tested 6

REFERENCE LABORATORY 12

A. The Testing Performed to support patient referral investigations includes: 13
B. Specimens Tested 13
C. Antibodies Identified 14

FETAL GENOTYPING 21

RHD RED CELL GENOTYPING 23

QUALITY INDICATORS 26

A. Turnaround Times 26

B. Rejected Specimens 27

Diagnostic services update 2019 29

Presentations / Abstracts / Publications Listing 32

FIGURES

Figure 1: Total Perinatal Specimens Tested 6

Figure 2: Total Number of Perinatal Antibodies 2019 9

Figure 3: Frequency of Clinically Significant Antibodies 2019 9

Figure 4: Total Reference Specimens Tested 14

Figure 5: Total Number of Reference Antibodies 17

Figure 6: Frequency of Reference Antibodies 18

Figure 7: Rh D Testing Algorithm 23

Figure 8: Perinatal Routine TAT 26

Figure 9: Reference TAT 27

Figure 10: Perinatal Rejection Reasons 2019 28

TABLES

Table 1: Perinatal Specimens Tested 6

Table 2: Total Number of Perinatal Antibodies Detected 7

Table 3: Perinatal Patient Antibody Titres 2019 8

Table 4: Combination Prenatal Antibodies 2019 10

Table 5: Reference Specimens Tested 13

Table 6: Total Number of Reference Antibodies Detected 15

Table 7: Combination Reference Antibodies 2019 19

Table 8a: Fetal Genotyping Results Summary 2019 21

Table 8b: Fetal Genotyping Results Totals 2019 22

Table 9: Patient # - RHD Type/Result 2019 24

Table 10: RHD Genotyping – Number of Rh Negative and Rh Positive Predicted Phenotypes 25

Table 11: Turnaround Time – Routine Criteria by Specimen Type 26

Table 12: Turnaround Time – Routine Perinatal Specimens 26

Table 13: Reference TAT 27

Table 14: Quarterly Rejection Rates – Perinatal Specimens 2019 28

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 RhIG treatment recommendation and the management of pregnancy when antibodies to red cell antigens are present.

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, if antibodies are detected
- Antibody Identification referrals
- Antibody Titration, if a clinically significant antibody is identified
- Phenotyping

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, obstetrical procedure, or fetal maternal hemorrhage).

Mothers – Antibody Present: If the antibody is known to cause HDFN, it is recommended that specimens be submitted every month followed by biweekly in the last trimester for the duration of the pregnancy dependant on the specificity of the antibody and the strength of the antibody titre.
For patients with titers of 16 or greater (and dependant on paternal phenotype) referral to Maternal Fetal Medicine clinic is recommended. 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.

Refer to **Fetal Genotyping** (page 21) for additional information.

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).

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.

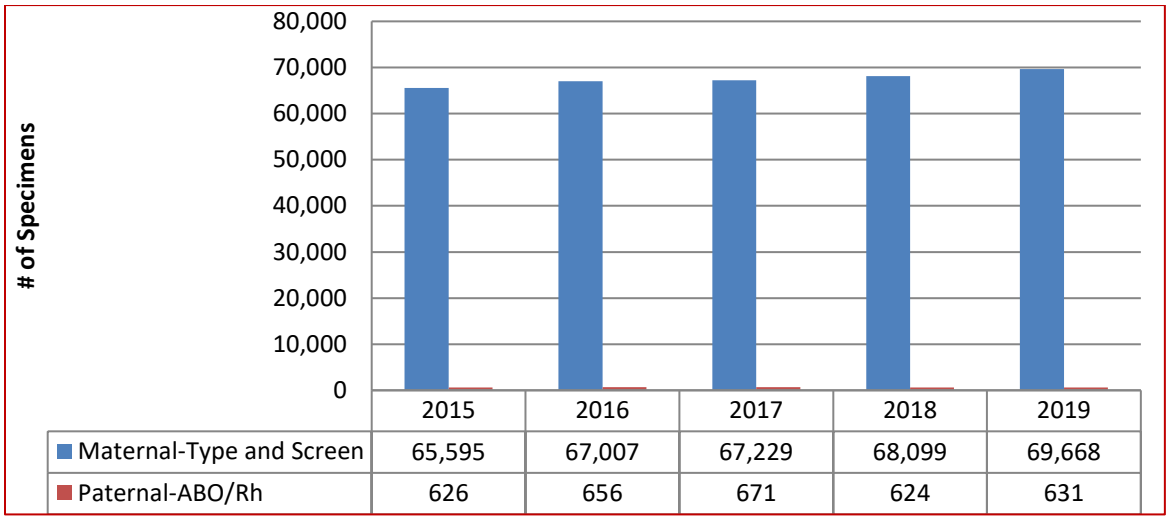
C. Specimens Tested

The data includes all women tested, including referrals.

Table 1: Perinatal Specimens Tested

Specimen Type	Test Type	2015	2016	2017	2018	2019
Maternal	Maternal-Type and Screen	65,595	67,007	67,229	68,099	69,668
Paternal	Paternal-ABO/Rh	626	656	671	624	631
Total # of Specimens Tested		66,221	67,663	67,899	68,723	70,299
Total # of Patients Tested		55,869	57,089	62,063	64,992	69,624

Figure 1: Total Perinatal Specimens Tested



D. Antibodies Identified

In 2019, a total of 342 antibodies were reported (see *Table 2*). This is less than 2018. Three hundred and seventy-nine women (379) had antibodies identified during their pregnancies (decreased from 507 women in 2018), of these; 257 women had clinically significant antibodies, 122 had clinically insignificant antibodies and 64 women had multiple antibodies. Passive anti-D data has been excluded from the preceding numbers. Antibodies identified were considered to be clinically significant if they have been reported to cause HDFN. The most common clinically significant antibodies identified were: anti-D, anti-E, anti-c, anti-K, (see *Figure 2*) which together represented 64% of the total antibodies identified. IgG Anti-M can also be considered clinically significant as it may cause HDFN and/or delayed anemia in rare cases.

Titres for 11 of the clinically significant antibodies increased from non-critical to critical levels during the pregnancy with a total of 19 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	46	38	52	48	39
Anti-C	8	5	7	26	11
Anti-Cw	2	2	1	0	2
Anti-Ce	1	0	0	0	0
Anti-c	14	11	30	65	26
Anti-E	85	80	101	150	80
Anti-e	3	3	2	4	6
Anti-G	1	2	4	6	7
Anti-K	41	33	41	70	55
Anti-Kpa	0	0	1	2	0
Anti-Lub	1	1	0	2	0
Anti-M*	46	47	49	52	37
Anti-S	8	6	8	13	11
Anti-s	2	2	1	0	0
Anti-U	0	0	0	2	0
Anti-Fya	4	1	8	12	7
Anti-Fyb	1	1	1	3	1
Anti-Jka	12	15	23	28	17
Anti-Jkb	2	1	8	4	8
Anti-Jk3	0	1	0	0	2
Anti-Vw	0	0	0	0	0
Anti-Wra	3	3	3	4	4
Anti-Jra	1	0	0	0	0
Anti-Inb	0	0	0	0	0
Anti-Sc1	1	0	0	0	0
Anti-Lua	1	0	1	2	0
Anti-Cob	1	0	0	0	1
Anti-Dantu	1	0	0	0	1
Anti-Joa	0	0	0	1	0
Anti-Mur	0	0	0	1	0
Anti-PP1Pk	0	0	0	1	0
Anti-Yta	1	0	1	2	0
Total	286	252	342	498	315

*Anti-M – IgG antibody component detected

Clinically Insignificant Antibodies	2015	2016	2017	2018	2019
Anti-A1	10	12	11	9	9
Anti-Lea	9	7	11	20	7
Anti-Leb	1	1	5	3	5
Anti-N	3	1		1	0
Anti-P1	23	20	19	2	6
Anti-Sda	6			0	0
Passive Anti-D *(not included in totals)*	651	681	726	588	687
TOTAL: Clinically Insignificant Antibodies	52	41	46	35	27

Table 3: Perinatal Patient Antibody Titres 2019

Antibody	Critical Level	Non-Critical Level	Non-Critical to Critical
Anti-C		4	
Anti-c	1	25	1
Anti-Ce	1	1	1
Anti-Cob		1	
Anti-CG		2	
Anti-Cw		7	
Anti-D	6	62	3
Anti-DC	1	3	
Anti-DG		2	
Anti-E	2	86	2
Anti-e		6	
Anti-Ec	2	14	1
Anti-Fya	1	6	
Anti-Fyb		1	
Anti-G		1	
Anti-HI		1	
Anti-Jk3		4	
Anti-Jka		24	
Anti-Jkb		10	
Anti-Lu14		3	
Anti-M	1	42	
Anti-S	2	9	2
Anti-Wra		5	
Combined Anti-Ce and anti-e	1	3	1
Combined Anti-D, anti-G and anti-E	1		
TOTAL	**19**	**322**	**11**

Figure 2: Total Number of Perinatal Antibodies 2019

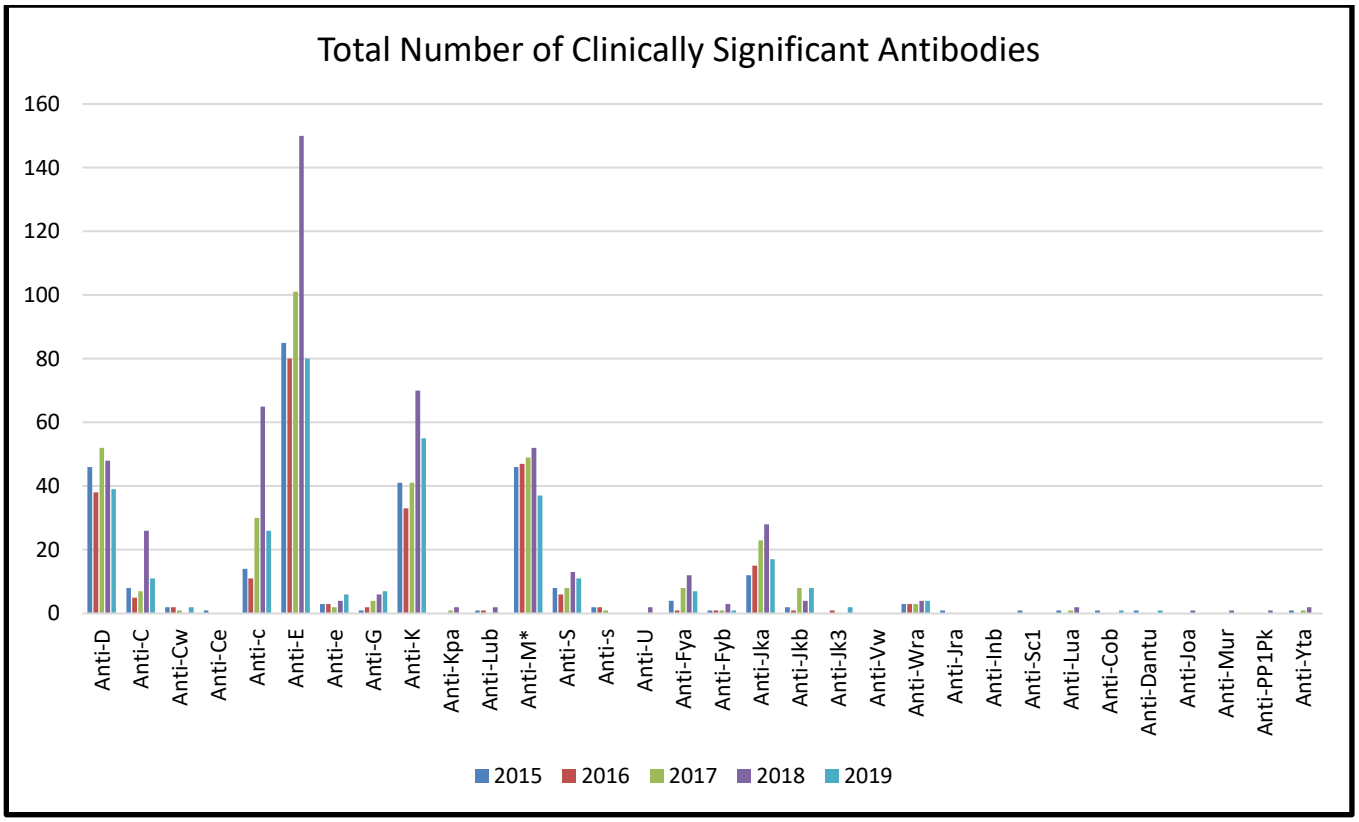


Figure 3: Frequency of Clinically Significant Antibodies 2019

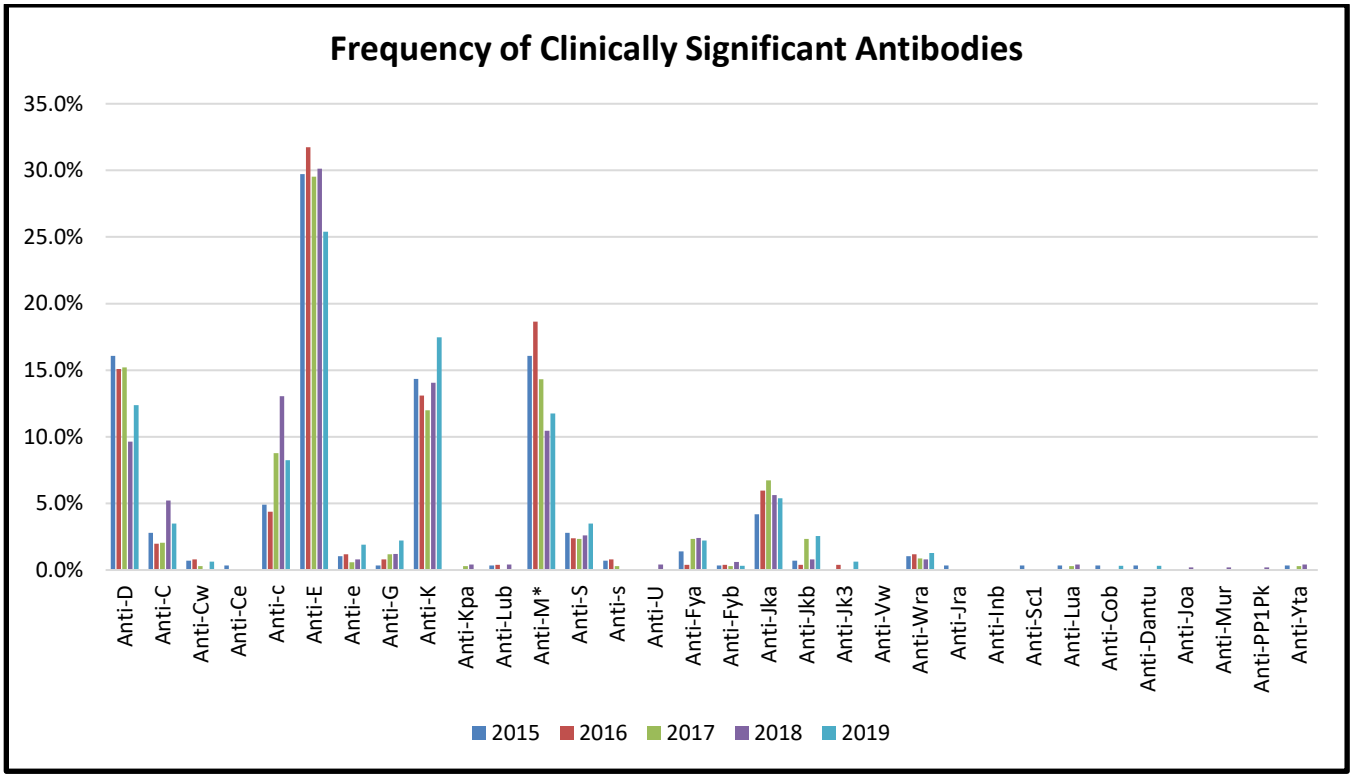


Table 4: Combination Prenatal Antibodies 2019

Combination Antibodies	Number
Anti-A1 Anti-E	1
Antibody to an HLA related antigen Unidentified Antibody	1
Anti-C Anti-E Unidentified Antibody	1
Anti-C Anti-e Unidentified Antibody	1
Anti-c Anti-Fya Anti-Jka	
Anti-C Anti-G	2
Anti-C Anti-G Anti-K	1
Anti-c Anti-Jka	1
Anti-c Unidentified Antibody	2
Anti-c Warm Autoantibody	
Anti-Ce Anti-e	1
Anti-D Anti-C	2
Anti-D Anti-C Unidentified Antibody	1
Anti-D Anti-E Anti-G	1
Anti-D Anti-G	1
Anti-D Anti-G Anti-Jka Warm Autoantibody Unidentified Antibody	1
Anti-E Anti-c	5
Anti-E Anti-c Anti-Fya	1
Anti-E Anti-c Anti-Jk3 Unidentified Antibody	1
Anti-E Anti-c Anti-Jka	1
Anti-E Anti-c Anti-K Unidentified Antibody	1
Anti-E anti-c Anti-S Anti-K	1
Anti-E Anti-c Unidentified Antibody	2
Anti-E Anti-Cw Anti-Cx Anti-Wra	1
Anti-E Anti-Fya	1
Anti-E Anti-Jka	1
Anti-E Anti-Jka Antibody to an HLA related antigen Unidentified Antibody	1
Anti-E Anti-Jkb	1
Anti-E Anti-K Anti-Kpa Anti-Wra	
Anti-E Anti-K Unidentified Antibody	1
Anti-e Anti-S Unidentified Antibody	1
Anti-E Anti-Wra	1
Anti-e Anti-Wra	1
Anti-E Unidentified Antibody	7
Anti-e Unidentified Antibody	1
Anti-Jkb Cold Agglutinin Unidentified Antibody	1

Combination Antibodies	Number
Anti-K Anti-Jka Unidentified Antibody	2
Anti-K Anti-Jkb	2
Anti-K Unidentified Antibody	2
Anti-Lea Anti-Leb	1
Anti-Leb Unidentified Antibody	1
Anti-M Anti-Fya	1
Anti-M Anti-K	1
Anti-M Warm Autoantibody Unidentified Antibody	1
Anti-P1 Unidentified Antibody	1
Anti-S Anti-Jka	1
Anti-S Anti-K Anti-Fya	1
Anti-S Unidentified Antibody	1
Anti-S Warm Autoantibody	1
Cold Agglutinin Unidentified Antibody	1
Total	**64**

REFERENCE LABORATORY

The Reference Laboratory, Vancouver 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 (24 hours, 7 days per week). The Reference Laboratory identifies red cell antibodies and provides transfusion recommendations. Diagnostic Services has a varied selection of specialized procedures and rare reagents to resolve more difficult red cell antibody cases. 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 437 requests for red cell antibody identification.

Diagnostic Services provides support for all BC and Yukon hospitals. 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. The Testing Performed to support patient referral investigations includes:

- ABO/Rh blood type and discrepancy investigations (if required)
- Screen for red blood cell antibodies
- Antibody Identification

- Phenotyping (patient and donor units)
- Transfusion Reaction Investigation
- Direct Antiglobulin Test
- Elution
- Allo and Auto Adsorptions
- Neutralization Tests
- Referral Genotype Testing

Antibody Screening is routinely performed by solid phase testing. A combination of solid phase testing and indirect antiglobulin tube testing using PEG for enhancement arethe primary antibody identification methods. Gel IAT testing may also be used.

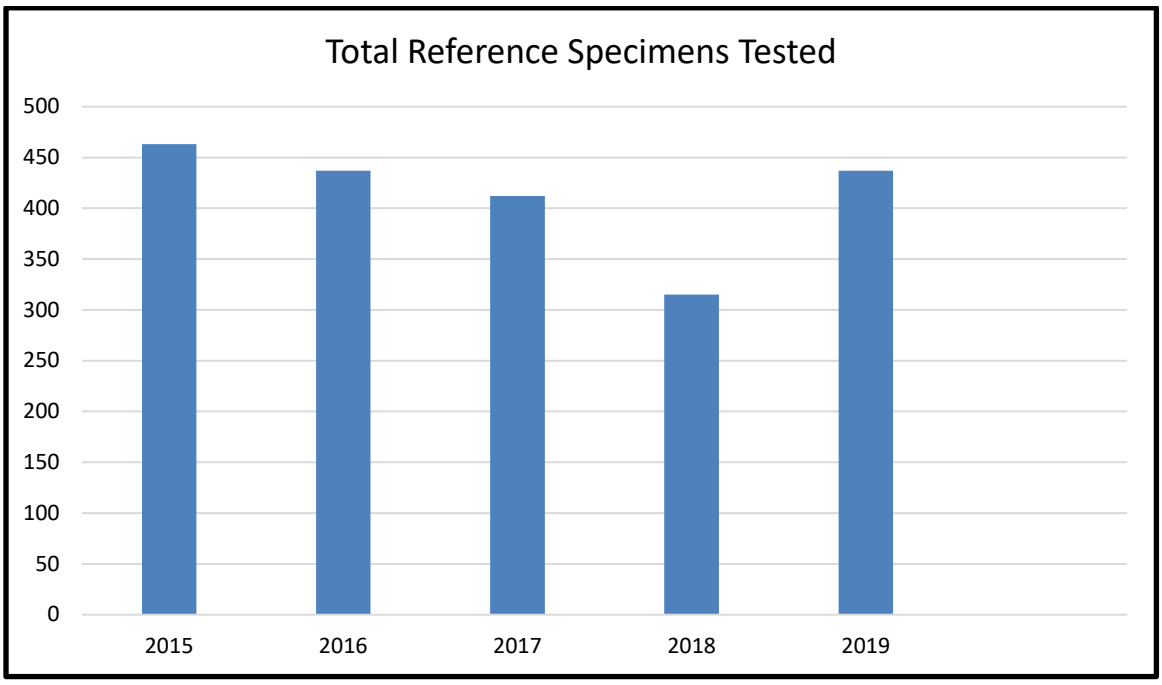
B. Specimens Tested

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	463	437	412	315	437

Figure 4: Total Reference Specimens Tested



C. Antibodies Identified

In 2019, a total of 238 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 sixty-five (265) patients had antibodies identified; of these, one hundred patients had multiple antibodies. Antibodies identified were 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-E, anti-K, anti-c, anti-Fya (see *Figure 5*) which together represented 59% of the total antibodies identified.

Investigation of warm autoantibodies is a frequent request. Techniques including such as auto and alloadsorption may be used along with DTT treatment of screening or panel cells for anti CD38-related panreactivity.

Table 6: Total Number of Reference Antibodies Detected

Reference Antibodies Identified					
Antibodies Detected	**2015**	**2016**	**2017**	**2018**	**2019**
Anti-D	46	38	52	15	50
Anti-A1	10	12	11	9	2
Anti-C	8	5	7	21	10
Anti-c	14	11	30	20	13
Anti-Ce	1				
Anti-Cob	1				
Anti-C^w	2	2	1	3	2
Anti-Dantu	1				1
Anti-E	85	80	101	40	42
Anti-e	3	3	2	6	7
Anti-f					1
Anti-Fya	4	1	8	15	12
Anti-Fyb	1	1	1	2	3
Anti-G	1	2	4	11	7
Anti-Ina					
Anti-Inb					
Anti-Jk3		1		3	1
Anti-Jka	12	15	23	10	10
Anti-Jkb	2	1	8	6	3
Anti-Jra	1				
Anti-K	41	33	41	26	23
Anti-k				1	
Anti-Kp^a			1	1	1
Anti-Kpb				1	
Anti-Lea	9	7	11	20	2
Anti-Leb	1	1	5	3	1
Anti-Lua	1		1		2
Anti-Lu^b	1				1
Anti-Lub		1			1
Anti-M	46	47	49	10	6
Anti-McCd/ Anti-Vil					1
Anti-Mia				2	
Anti-Mur				1	

Reference Antibodies Identified					
Antibodies Detected	**2015**	**2016**	**2017**	**2018**	**2019**
Anti-N	3	1		1	1
Anti-P1	23	20	19	2	2
Anti-S	8	6	8	9	6
Anti-s	2	2	1		
Anti-Sc1	1				
Anti-Sda	6			0	2
Anti-V			1		
Anti-Vw				1	
Anti-Wra	3	3	3	2	3
Anti-Yta	1		1		
Warm autoantibody					181
Cold agglutinin					42
Antibody to an HLA related antigen					3
Antibody to a High Prevalence Antigen					5
Unidentified Antibody					41
Autoantibody					2
Antibody to a Low Prevalence Antigen					1
Passive Anti-D	28	15	19	19	22
TOTAL:	**366**	**308**	**408**	**260**	**513**

Figure 5: Total Number of Reference Antibodies

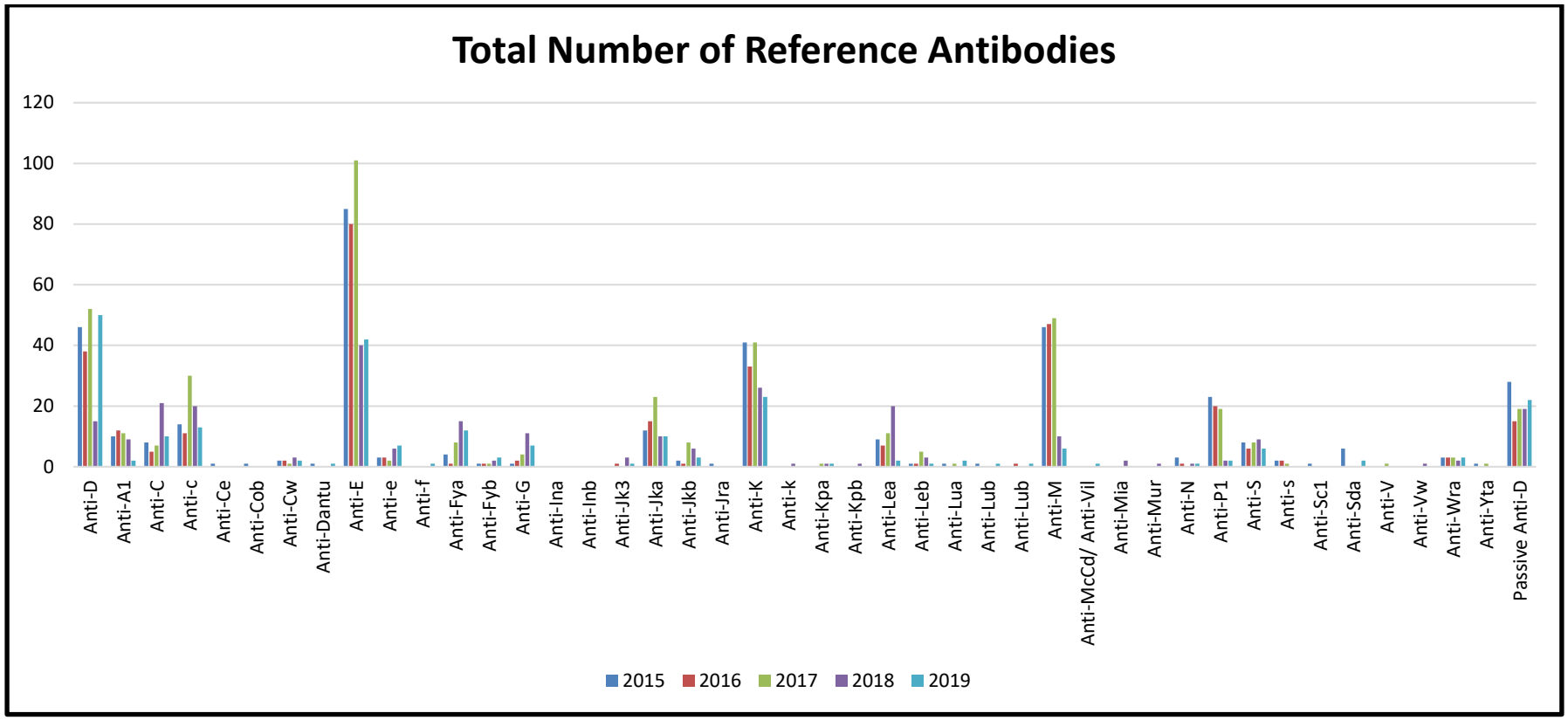


Figure 6: Frequency of Reference Antibodies

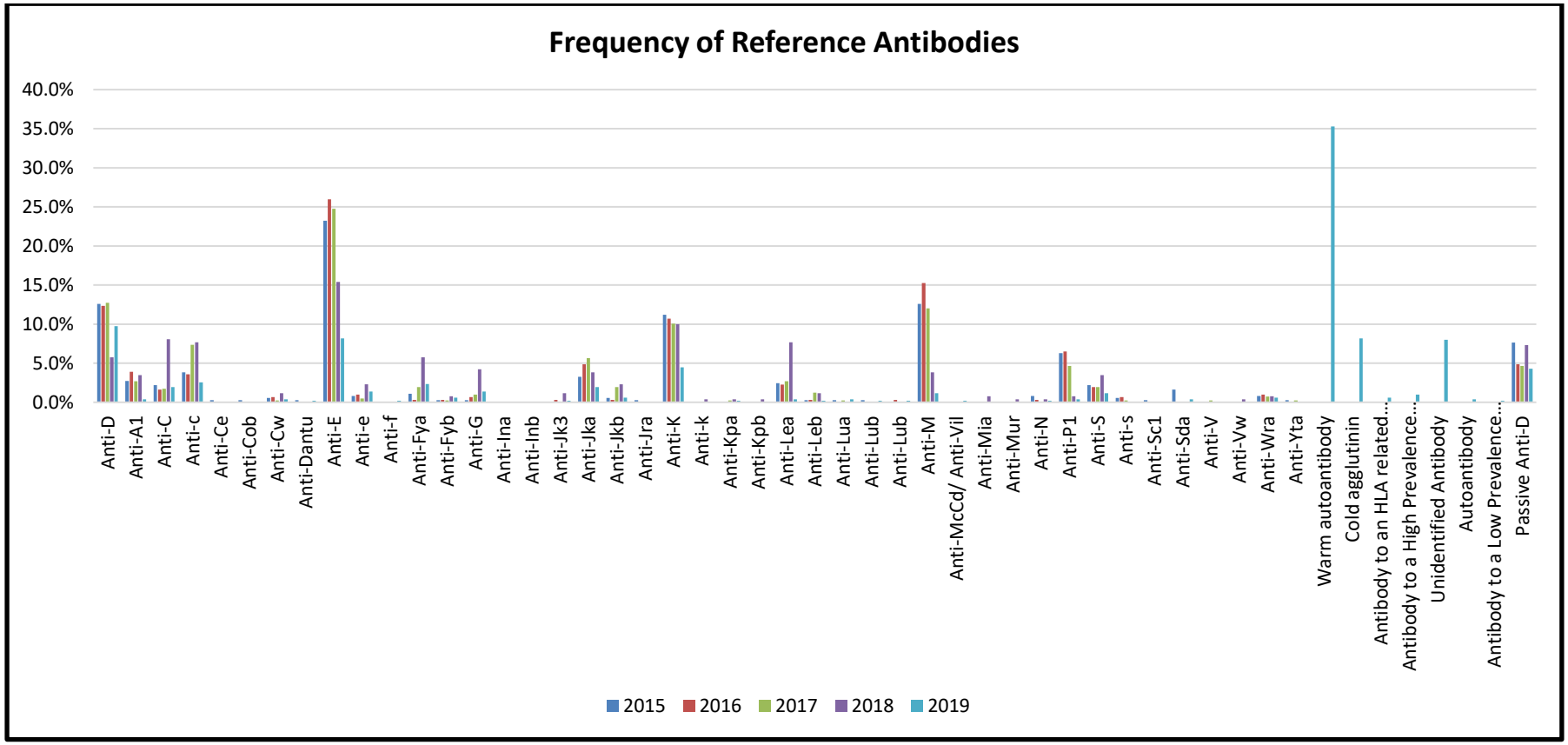


Table 7: Combination Reference Antibodies 2019

Combination Antibodies	Serology
Antibody to a High Prevalence Antigen Unidentified Antibody	1
Anti-c Anti-Fya Anti-Jka	1
Anti-C Anti-G	1
Anti-c Anti-Jka	1
Anti-C Unidentified Antibody	1
Anti-C Warm Autoantibody	3
Anti-c Warm Autoantibody	1
Anti-Cw Anti-c	1
Anti-Cw Anti-E Warm Autoantibody	1
Anti-D Anti-C	4
Anti-D Anti-C Antibody to an HLA related antigen	1
Anti-D Anti-C Anti-E Anti-Sda	1
Anti-D Anti-C Unidentified Antibody	
Anti-D Anti-E Anti-G	1
Anti-D Anti-G	4
Anti-Dantu Anti-Sda	1
Anti-E Antibody to a Low Prevalence Antigen	1
Anti-E Antibody to an HLA related antigen	1
Anti-E Anti-c	3
Anti-E Anti-c Anti-Jka Warm Autoantibody Unidentified Antibody	1
Anti-E Anti-c Anti-K Anti-Fya	1
Anti-E Anti-c Unidentified Antibody	1
Anti-E Anti-c Warm Autoantibody	1
Anti-e Anti-Fyb	1
Anti-E Anti-Jka	1
Anti-E Anti-Jka Warm Autoantibody Cold Agglutinin Unidentified Antibody	1
Anti-E Anti-Jkb	
Anti-e Anti-K	1
Anti-E Anti-K	1
Anti-E Anti-K Anti-Fya Anti-Jkb	1
Anti-E Anti-K Anti-Kpa Anti-Wra	1

Combination Antibodies	Serology
Anti-E Anti-K Warm Autoantibody	3
Anti-E Anti-K Warm Autoantibody Cold Agglutinin	1
Anti-E Anti-Leb Warm Autoantibody	1
Anti-E Anti-M Anti-K	1
Anti-e Anti-S Anti-Fya Warm Autoantibody	1
Anti-E Anti-S Warm Autoantibody	1
Anti-E Cold Agglutinin	1
Anti-E Unidentified Antibody	1
Anti-e Unidentified Antibody	1
Anti-E Warm Autoantibody	5
Anti-E Warm Autoantibody Cold Agglutinin	2
Anti-f Anti-Fyb Anti-Lua	1
Anti-Fya Anti-Dia	1
Anti-Fya Anti-Jka Warm Autoantibody	1
Anti-Fya Unidentified Antibody	2
Anti-Jka Warm Autoantibody	2
Anti-K Anti-Mia	1
Anti-K Unidentified Antibody	2
Anti-K Warm Autoantibody	2
Anti-Lea Warm Autoantibody	1
Anti-LW Warm Autoantibody	1
Anti-M Anti-Jka	1
Anti-M Anti-Lua Unidentified Antibody	1
Anti-S Anti-Fya	1
Anti-S Anti-Fyb Warm Autoantibody	1
Anti-S Anti-K Anti-Fya	1
Anti-S Unidentified Antibody	1
Anti-Wra Unidentified Antibody	1
Anti-Wra Warm Autoantibody	1
Autoantibody Cold Agglutinin	1
Cold Agglutinin Unidentified Antibody	3
Warm Autoantibody Cold Agglutinin	12
Warm Autoantibody Unidentified Antibody	5
Total	**100**

FETAL GENOTYPING

Canadian Blood Services in BC refers specimens for fetal blood group genotyping from maternal plasma to the International Blood Group Reference Laboratory (IBGRL) of the National Health Services (NHS) in Bristol, United Kingdom.

Specimens are submitted through the Maternal Fetal Medicine clinics in BC 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, and
- The antibody is RH and/or anti-K

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

Table 8a: Fetal Genotyping Results Summary 2019

Patient	Maternal Antibody	Predicted Fetal Phenotype	Follow-up Required
1	Anti-E	E+	Yes
2	Anti-E,c	c-	No
3	Anti-D, C	D+	Yes
4	Anti-K, Jkb	K+	Yes
5	Anti-K	N/A (Not done. Father K-)	No
6	Anti-E, Jkb	E+	Yes
7	Anti-E	E+	Yes
8	Anti-C,G	D-	No
9	Anti-D	D+	Yes
10	Anti-D	D+	No
11	Anti-K	K-	No
12	Anti-M Anti-K	Results indeterminate	Yes
13	Anti-D Anti-E Anti-G	D-, E-	No
14	Anti-K	K+	Yes
15	Anti-D, anti-E, anti-G	D+ (NSQ for E genotype)	Yes
16	Anti-K	K-	No
17	Anti-D, anti-Jka	D+	Yes
18	Anti-D	D+	Yes

Patient	Maternal Antibody	Predicted Fetal Phenotype	Follow-up Required
19	Anti-E, anti-c, anti-S, anti-K	E+, c+	Yes
20	Anti-D, C	D-, C-	No
21	Anti-K	K+	Yes
22	Anti-D	D+	Yes
23	Anti-D	D+	Yes

Table 9b: Fetal Genotyping Results Totals 2019

	2019
Total samples sent	25
# of patients tested	**23**
# of patients not requiring MFM follow-up. (Fetus tested negative for the corresponding antigen)	**8**

Note: Data not captured prior to 2019

RHD RED CELL GENOTYPING

Based on the following testing algorithm patients with a serologically variable Rh D typing results may have a genetic testing for the RHD gene. For 2019, the following results were obtained in patients using one of the two Red Cell antigen genotyping platforms available at CBS:

Figure 7: Rh D Testing Algorithm

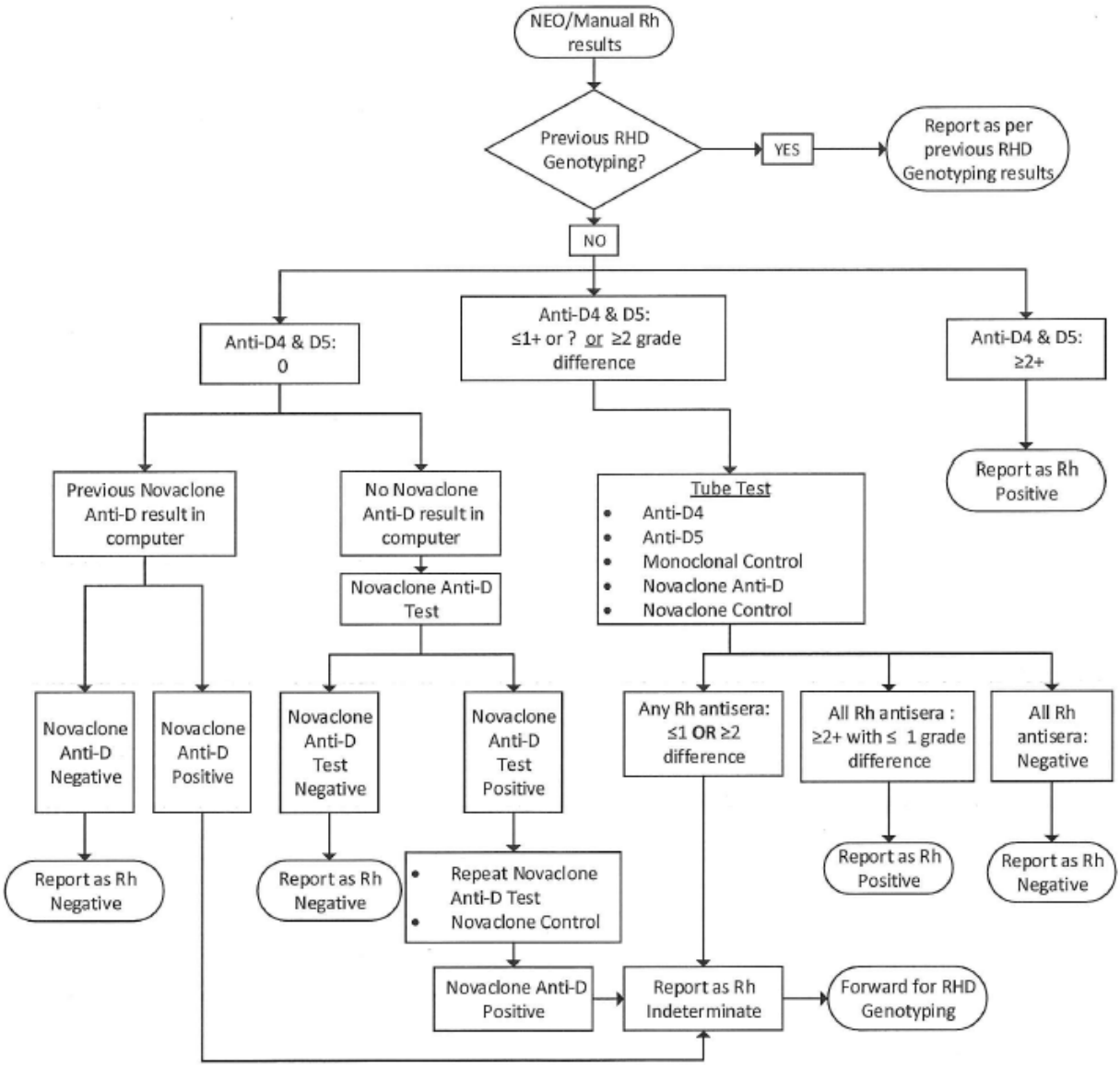


Table 10: Patient # - RHD Type/Result 2019

# of Patients	RHD Genotype	Predicted Phenotype	RHD Sequencing	Rh(D) Group
5	DAR	Partial D	NO	NEG
2	DAU4 of DV type 5	D variant	NO	NEG
1	DHMi	D variant	NO	NEG
2	DOL or DOL2	Variant D	NO	NEG
16	Possible D	D positive	NO	POS
1	RHD *705T	D variant	Yes	NEG
1	RHD Deletion	RHD Deletion	NO	NEG
44	Weak D type 1	weak D	NO	POS
24	Weak D type 2	weak D	NO	POS
21	Weak D type 3	weak D	NO	POS
1	Weak D type 1/Weak D type 3	weak D	NO	POS
10	Weak D type 4.0 or 4.3	weak D	NO	NEG
1	Weak D type 4.0 or 4.3/DIIIa-CE(4-7)-D	weak D	NO	NEG
1	weak D type 4.1	weak D	NO	NEG
130	Total number tested			

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

	2019
Rh Positive	106
Rh Negative	24
Total # samples tested	130

Note: Data not captured prior to 2019

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 the specimen is received at Canadian Blood Services in Vancouver to the time when the results are available. Since monitoring of this quality indicator began in 2008, the percentage of specimens has consistently exceeded the predefined TAT threshold. Samples whose testing exceeds the expected TAT are usually those where clinically significant antibodies are detected or where difficulty in finding compatible blood is encountered.

Table 12: 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 13: Turnaround Time – Routine Perinatal Specimens

Turnaround Time (TAT)	2015	2016	2017	2018	2019
% of Specimens Tested within 72 hours	89%	89%	91%	89%	88%
% of Specimens Tested > 72 hours	11%	11%	9%	11%	12%

Figure 8: Perinatal Routine TAT

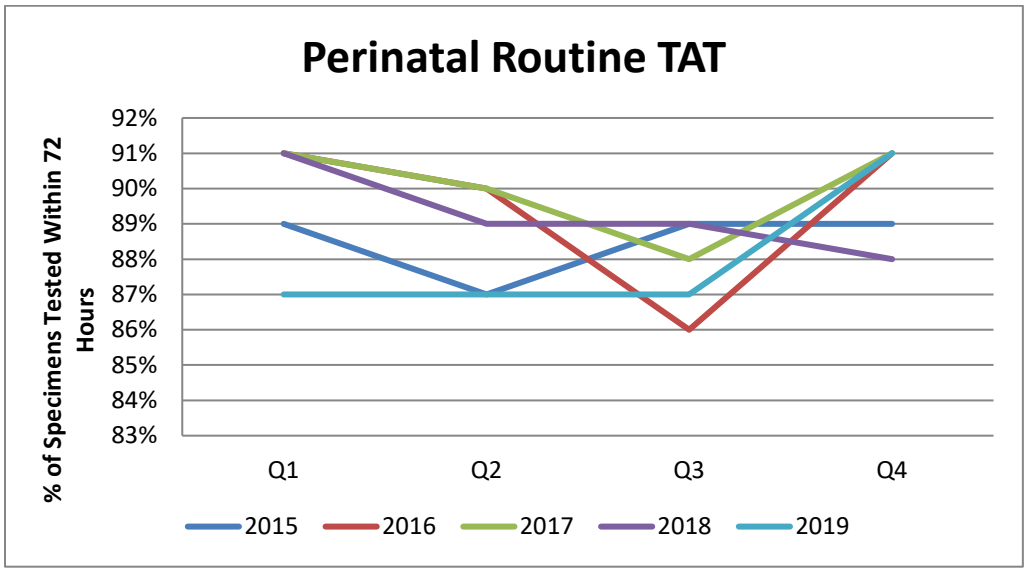
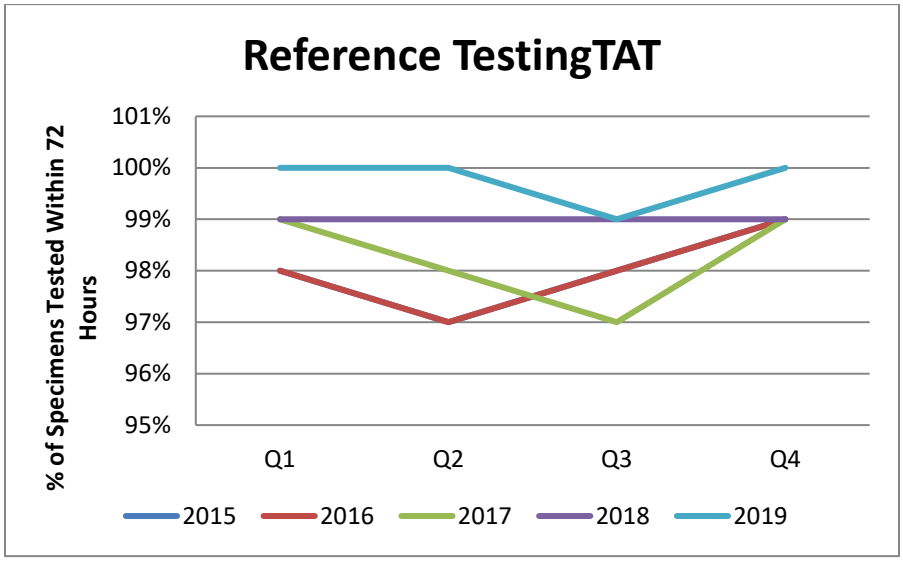


Table 14: Reference TAT

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

Figure 9: Reference TAT



B. Rejected Specimens

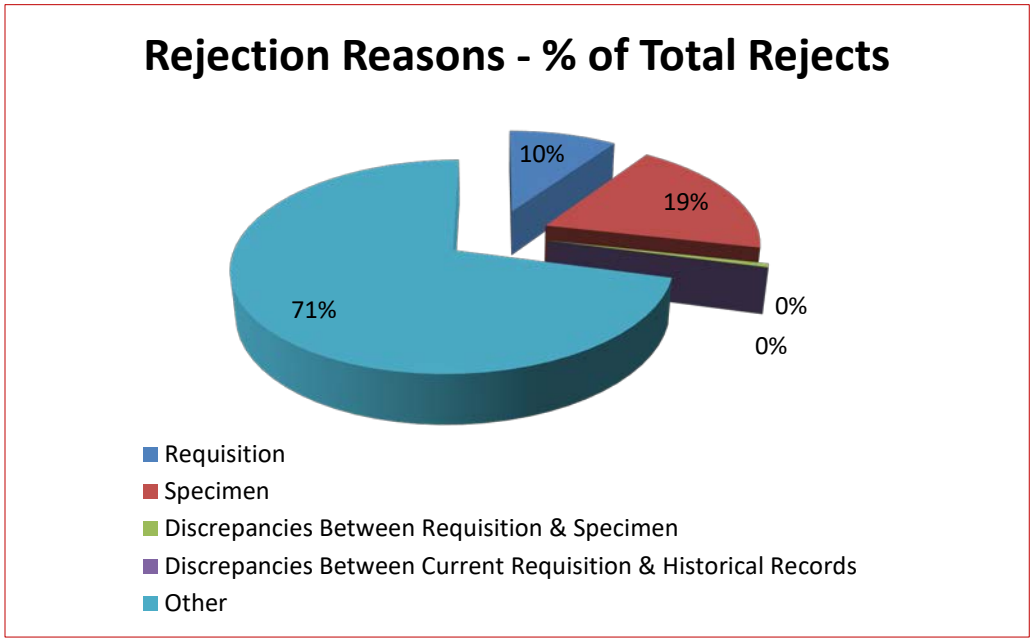
Each time a specimen is rejected, a reason for rejection is entered into our Laboratory Information System. This data is then retrieved and analyzed on a quarterly basis. The number of rejected specimens is quite low for both perinatal and reference specimens. Reference specimens come from hospitals and perinatal samples are primarily collected at external collection sites.

For perinatal specimens, the most common reason for rejecting a sample is that the sample is a duplicate. Samples are rejected if another sample from the patient was tested within the previous week. Often a duplicate 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 BC patients on Care Connect (BC's Electronic Health Record).

Table 15: Quarterly Rejection Rates – Perinatal Specimens 2019

Rejection Category	Q1	Q2	Q3	Q4
Requisition	1	8	7	18
Specimen	15	5	11	36
Discrepancies Between Requisition & Specimen	0	1	0	1
Discrepancies Between Current Requisition & Historical Records	0	0	0	0
Other (Duplicates, etc.)	46	53	69	83
Total # specimens rejected	62	67	87	138
Total # specimens received	16142	17108	15833	19679
Rejections as a % of total	**0.5%**	**0.4%**	**0.4%**	**0.5%**

Figure 10: Perinatal Rejection Reasons 2019



DIAGNOSTIC SERVICES UPDATE 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.
	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

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.