DIAGNOSTIC SERVICES

British Columbia / Yukon

YEAR IN REVIEW

JANUARY – DECEMBER 2021

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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PERINATAL LABORATORY

The Perinatal Laboratory within Diagnostic Services at Canadian Blood Services provides diagnostic testing of perinatal samples 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

Automated ABO/Rh, Antibody Screen, and Antibody Identification assays are routinely performed on the Immucor NEO Iris analyzer (hemagglutination testing and solid phase). Manual follow up testing includes the use of PEG, LISS and other methods.

B. Testing Frequency

Prenatal – Initial Testing: All patients should be tested upon their first prenatal visit.

Prenatal – 26-28 Weeks Gestation: All Rh-negative patients should be retested at 26-28 weeks gestation. Rh positive patients 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, trauma, obstetrical procedure, or fetal maternal hemorrhage).

Prenatal – 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.

Postnatal: Following delivery, specimens from the patient and baby should be tested if the Rh of the patient is unknown, the patient is Rh negative, the patient has a clinically significant antibody or if the baby shows signs of HDFN (i.e., anemia or jaundice).

Partners: When a prenatal patient 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 patients.

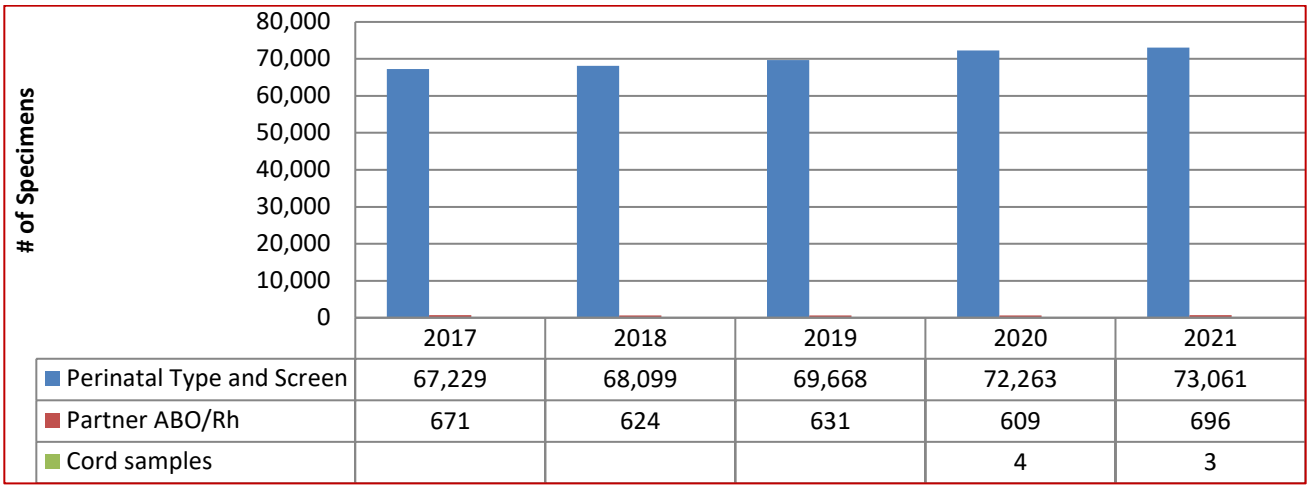
C. Specimens Tested

The data includes all perinatal patients tested, including referrals. The data in this report reflects a calendar year period to enable better correlation to other government statistical data (Statistics Canada birth statistics).

Table 1: Perinatal Specimens Tested

Specimen Type	Test Type	2016	2017	2019	2020	2021
Perinatal	Perinatal-Type and Screen	67,229	68,099	69,668	72,263	73, 061
Partner	Partner-ABO/Rh	671	624	631	609	696
Cord samples	ABO/Rh	Not reported	Not reported	Not reported	4	3
Total # of Specimens Tested		67,899	68,723	70,299	72,876	73, 760
Total # of Patients Tested		**62,063**	**64,992**	**69,624**	**60,677**	**59.891**

Figure 1: Total Perinatal Specimens Tested



D. Antibodies Identified

In 2021, a total of 395 antibodies were reported (see *Table 2*). This is less than 2020. Three hundred and fifty-seven patients (357) had antibodies identified during their pregnancies (decreased from 381 in 2020), of these; 259 patients had clinically significant antibodies, 64 had clinically insignificant antibodies and 62 patients 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 62% 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 26 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

Perinatal Antibodies Identified – 2021					
Clinically Significant Antibodies	**2017**	**2018**	**2019**	**2020**	**2021**
Anti-D	52	48	39	54	41
Anti-C	7	26	11	11	8
Anti-C^{w}	1	0	2	3	1
Anti-Ce	0	0	0		1
Anti-c	30	65	26	27	30
Anti-E	101	150	80	72	60
Anti-e	2	4	6	4	5
Anti-G	4	6	7	7	6
Anti-K	41	70	55	38	37
Anti-Kp^{a}	1	2	0		0
Anti-Lu^{b}	0	2	0		0
Anti-M*	49	52	37	38	35
Anti-S	8	13	11	10	9
Anti-s	1	0	0		1
Anti-U	0	2	0		0
Anti-Fya	8	12	7	4	3
Anti-Fyb	1	3	1	2	1
Anti-Jka	23	28	17	16	19
Anti-Jkb	8	4	8	6	8
Anti-Jk3	0	0	2	1	0
Anti-Vw	0	0	0		0
Anti-Wra	3	4	4	2	1
Anti-Jra	0	0	0		0
Anti-Inb	0	0	0		0
Anti-Sc1	0	0	0	1	1
Anti-Lua	1	2	0	1	0
Anti-Cob	0	0	1		0
Anti-Dantu	0	0	1	2	0
Anti-Joa	0	1	0		0
Anti-Mur	0	1	0	1	1
Anti-PP1Pk	0	1	0		0
Anti-Yta	1	2	0		0
Anti-Lu14	0	0	0	2	1
Anti-Dia	0	0	0	2	0
Anti-Mit	0	0	0	1	0
Total	**342**	**498**	**315**	**300**	**269**

*Anti-M – IgG antibody component detected

Clinically Insignificant Antibodies	2017	2018	2019	2020	2021
Anti-A1	11	9	9	15	12
Anti-Lea	11	20	7	11	5
Anti-Leb	5	3	5	4	4
Anti-N		1	0	2	3
Anti-P1	19	2	6	6	10
Anti-Sda		0	0		0
Antibody to an HLA related antigen	Not reported	Not reported	Not reported	5	0
Cold Agglutinin	Not reported	Not reported	Not reported	11	9
Warm autoantibody	Not reported	Not reported	Not reported	44	32
Unidentified antibody	Not reported	Not reported	Not reported	54	51
Passive Anti-D *(not included in totals)*	726	588	687	719	594
TOTAL: Clinically Insignificant Antibodies	**46**	**35**	**27**	**152**	**126**

Table 3: Perinatal Patient Antibody Titres 2021

Antibody	Critical Level	Non-Critical Level	Non-Critical to Critical
Anti-C	2	21	2
Anti-c		3	
Anti-Ce		2	
Anti-cE		1	
Anti-CG			
Anti-Cw		1	
Anti-D	6	44	4
Anti-DC	3	1	
Anti-DG	5		1
Anti-DG			
Anti-Dia			
Anti-E	6	48	3
Anti-e		5	
Anti-Ec	3	5	
Anti-Fya		1	
Anti-Fyb		1	
Anti-G		1	1
Anti-Jk3			
Anti-Jka		18	
Anti-Jkb		9	
Anti-Lu14		1	
Anti-Lua			

Antibody	Critical Level	Non-Critical Level	Non-Critical to Critical
Anti-M		33	
Anti-Mit			
Anti-Mur			
Anti-S		8	
Anti-s		1	
Anti-Sc1		1	
Anti-Wra	1		
Totals	**26**	**205**	**11**

Figure 2: Total Number of Perinatal Antibodies 2021

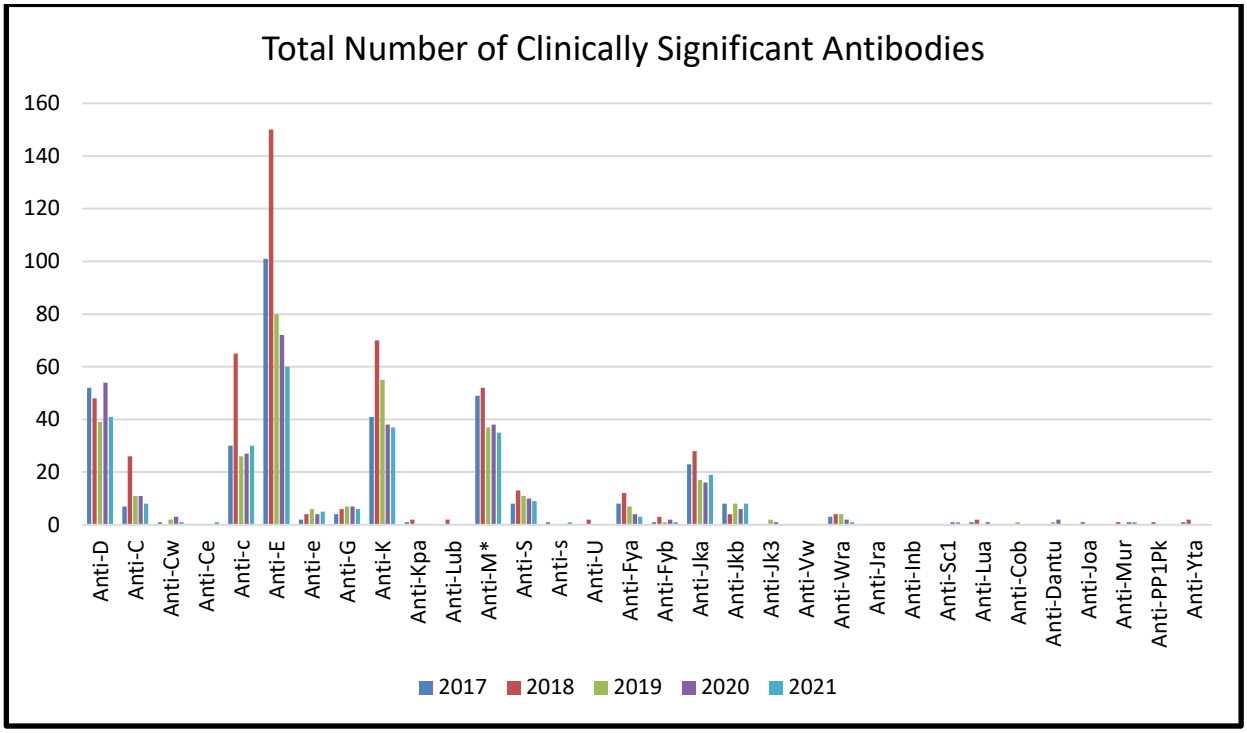


Figure 3: Frequency of Clinically Significant Antibodies 2021

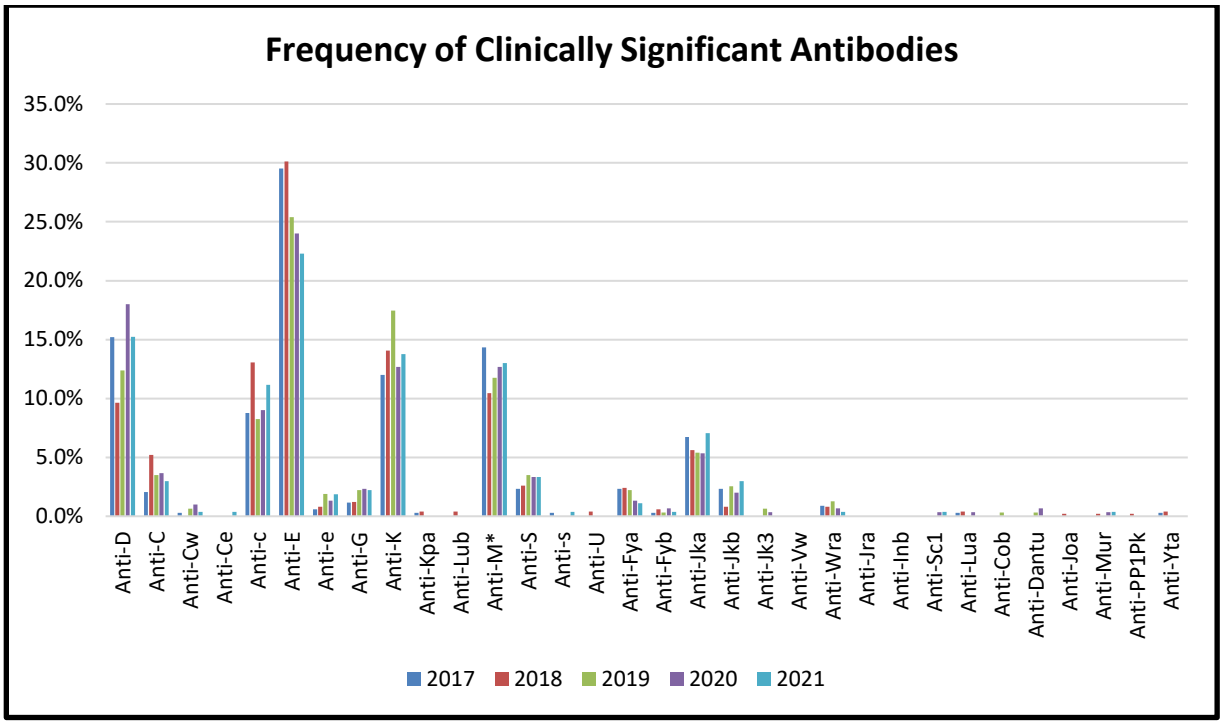


Table 4: Combination Prenatal Antibodies 2021

Combination Antibodies	Prenatal
Anti-C, Unidentified Antibody	1
Anti-Anti-P1, Anti-K, Unidentified Antibody	1
Anti-C, Anti-e	1
Anti-c, Anti-Jka, Warm Autoantibody	1
Anti-C, Wra, Unidentified Antibody	1
Anti-D, Anti-C	1
Anti-D, Anti-C, Anti-Jkb	1
Anti-D, Anti-C, Unidentified Antibody	1
Anti-D, Anti-G	2
Anti-D, Anti-G, Unidentified Antibody	4
Anti-D, Anti-P1	2
Anti-D, Unidentified Antibody	1
Anti-E, Anti-c	8
Anti-E, Anti-c, Anti-K, Anti-Jka	1
Anti-e, Anti-Ce	1
Anti-E, Anti-Jka	1
Anti-E, Anti-Lea, Anti-K	1
Anti-e, Anti-P1	1
Anti-E, Anti-S	1
Anti-E, Unidentified Antibody	1
Anti-Fyb, Anti-Jka, Unidentified Antibody	1
Anti-Jka, Unidentified Antibody	3

Combination Antibodies	Prenatal
Anti-Jkb, Unidentified Antibody	1
Anti-K, Unidentified Antibody	1
Anti-Lea, Anti-Jka	1
Anti-Lea, Anti-Leb	1
Anti-Lea, Anti-Leb, Unidentified Antibody	1
Anti-M, Anti-Fya	1
Anti-M, Anti-K	1
Anti-M, Unidentified Antibody	3
Anti-s, Anti-Jka, Unidentified Antibody	1
Anti-S, Warm Autoantibody	3
Cold Agglutinin, Unidentified Antibody	1
Warm Autoantibody, Cold Agglutinin	1
Warm Autoantibody, Unidentified Antibody	1

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 2021, hospitals have referred 401 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:

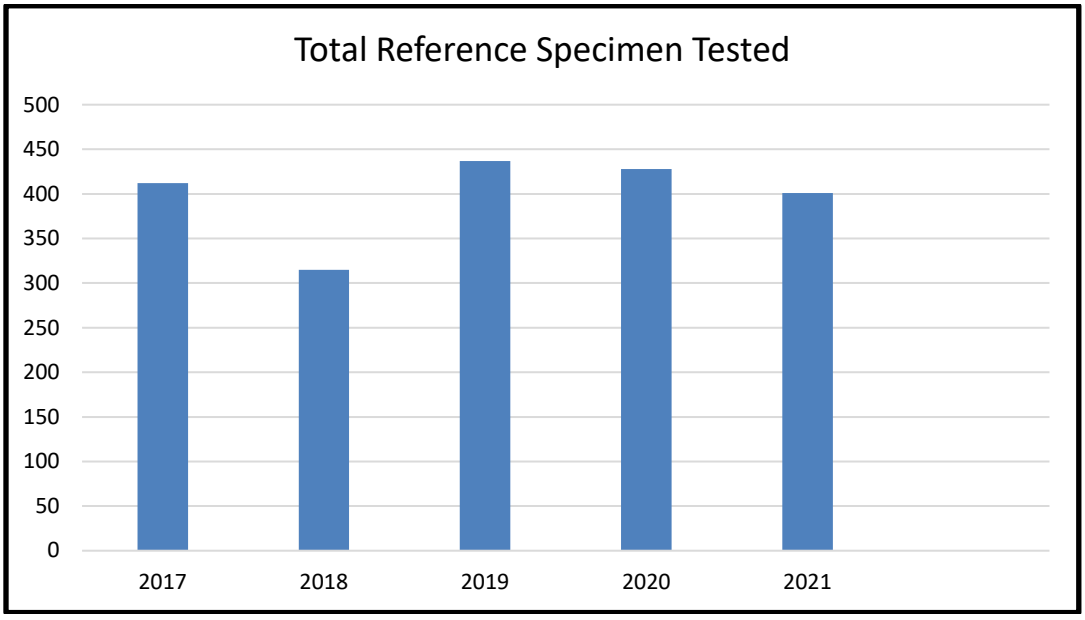
- ABO/Rh blood type and discrepancy investigations (if required)
- Screen for red blood cell antibodies
- Antibody Identification
- Phenotyping (patient and donor units)
- Transfusion Reaction Investigation
- Direct Antiglobulin Test
- Elution
- Allo and Auto Adsorptions
- Neutralization Tests
- Referral 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.

Table 5: Reference Specimens Tested

Specimen Type	2017	2018	2019	2020	2021
Total Reference Antibody Investigations	412	315	437	428	401

Figure 4: Total Reference Specimens Tested



B. Antibodies Identified

In 2021, a total of 436 antibodies were reported (see *Table 6*). The total number of antibodies detected is the same as 2020, and the distribution of the most common antibodies remains consistent. Four hundred and seventeen (417) patients had antibodies identified; of these, two hundred and seventy-two (272) 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 22% 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 (Including Passive D) – (Current Year) 2021					
Antibodies Detected	**2017**	**2018**	**2019**	**2020**	**2021**
Anti-D	52	15	50	11	6
Anti-A1	11	9	2		2
Anti-C	7	21	10	19	12
Anti-c	30	20	13	12	13
Anti-Ce					0
Anti-Ch				1	2
Anti-Cob				1	0
Anti-C^w	1	3	2	7	2
Anti-Dantu			1		0
Anti-Dia				1	0
Anti-E	101	40	42	40	40
Anti-e	2	6	7	2	9
Anti-f			1		0
Anti-Fya	8	15	12	8	10
Anti-Fyb	1	2	3	3	6
Anti-Fy3				1	0
Anti-G	4	11	7	7	6
Anti-Ge2					1
Anti-hrS					1
Anti-Ina					0
Anti-Inb					0
Anti-Jk3		3	1	1	0
Anti-Jka	23	10	10	14	11
Anti-Jkb	8	6	3	2	6
Anti-JMH				1	0
Anti-Jra				1	0
Anti-K	41	26	23	26	23
Anti-k		1		1	0
Anti-Kp^a	1	1	1	5	3
Anti-Kpb		1			0
Anti-Lea	11	20	2	3	3
Anti-Leb	5	3	1	2	1
Anti-Lua	1		2	1	5
Anti-Lub			2		0
Anti-Lu14				1	0

Reference Antibodies Identified (Including Passive D) – (Current Year) 2021					
Antibodies Detected	**2017**	**2018**	**2019**	**2020**	**2021**
Anti-LW				1	0
Anti-M	49	10	6	11	6
Anti-McCd/ Anti-Vil			1	2	0
Anti-Mia		2			2
Anti-Mur		1			1
Anti-N		1	1	1	0
Anti-P1	19	2	2	5	1
Anti-S	8	9	6	8	16
Anti-s	1				0
Anti-Sc1					0
Anti-Sda		0	2		0
Anti-U				1	0
Anti-V	1				1
Anti-Vel				1	1
Anti-Vw		1			0
Anti-Wra	3	2	3	4	6
Anti-Yka					1
Anti-Yta	1				0
Antibody to a Low Prevalence Antigen				1	0
Antibody to an HLA related antigen				1	2
Autoantibody				1	1
Warm autoantibody				131	137
Cold Agglutinin				33	36
Unidentified antibody				37	44
Passive Anti-D	19	19	22	27	19
TOTAL:	**408**	**260**	**238**	**436**	**436**

Figure 5: Total Number of Reference Antibodies

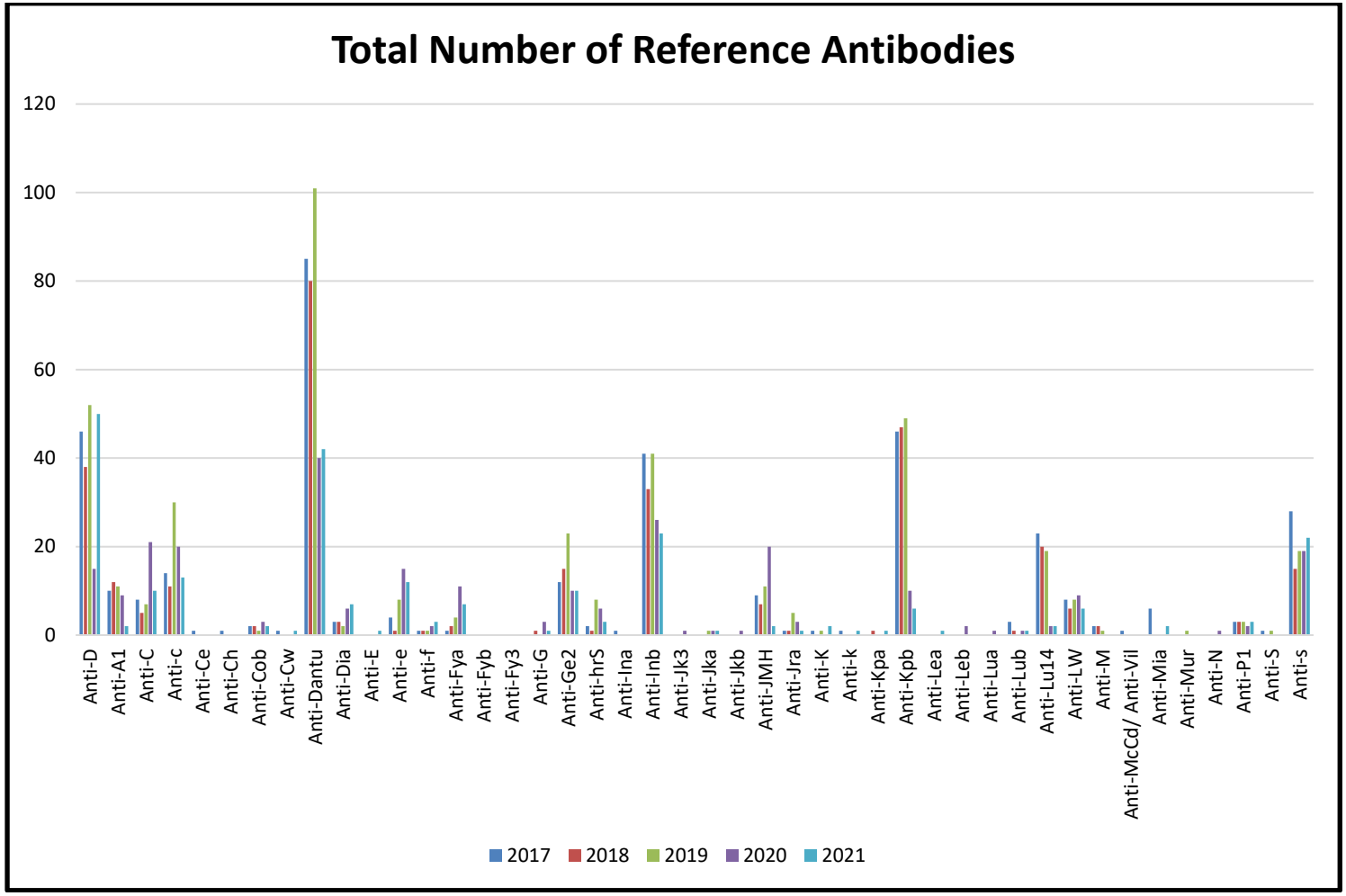


Figure 6: Frequency of Reference Antibodies

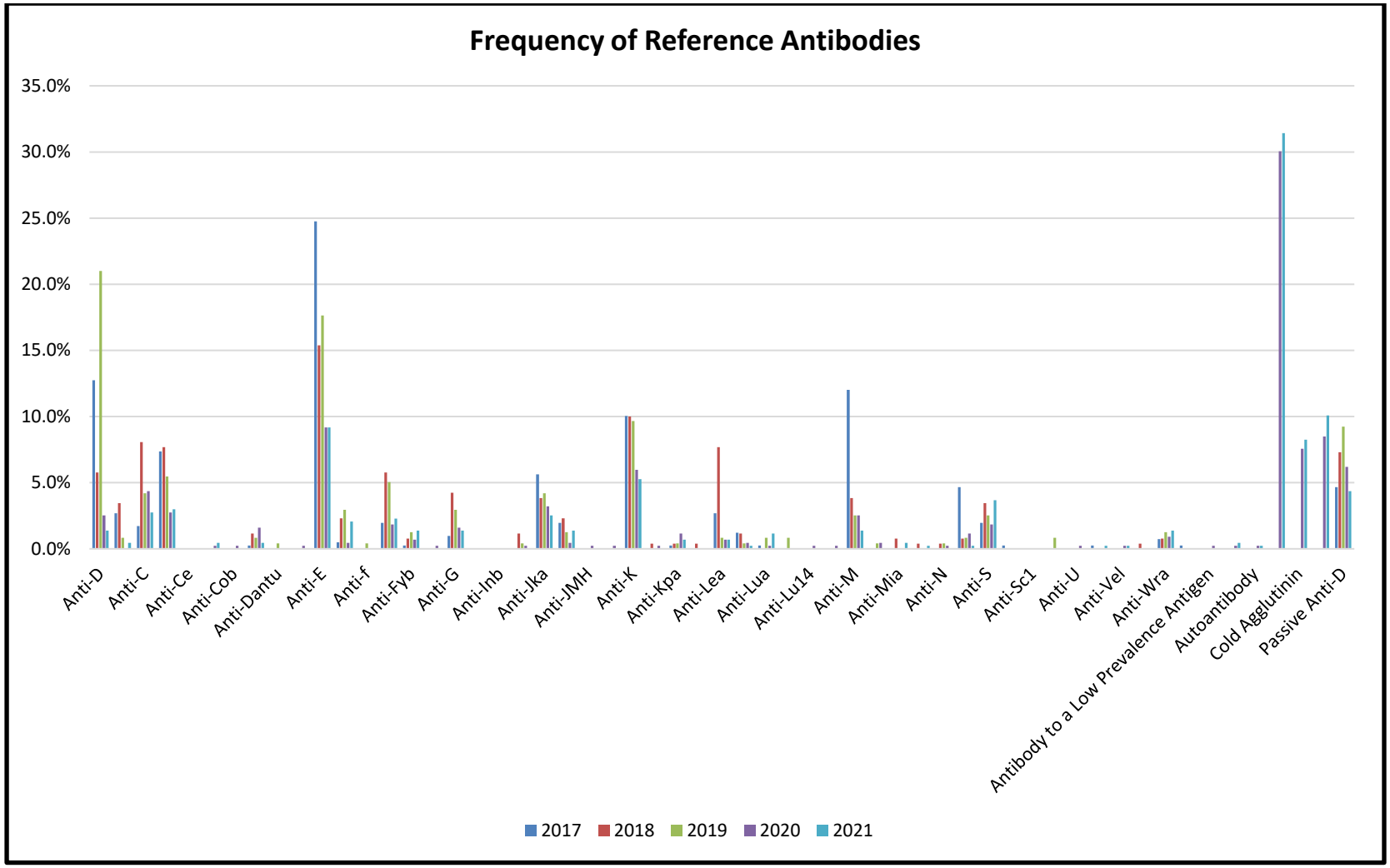


Table 7: Combination Reference Antibodies 2021

Combination Antibodies	Serology
Antibody to an HLA related antigen, Unidentified Antibody	1
Anti-C, Anti-D, Anti-Fya	1
Anti-C, Anti-D, Warm Autoantibody	1
Anti-C, Anti-E, Anti-Jka	1
Anti-C, Anti-E, Anti-K	2
Anti-C, Anti-e, Unidentified Antibody	1
Anti-c, Anti-Fya, Cold Agglutinin	1
Anti-C, Anti-G	3
Anti-C, Anti-K, Anti-S, Anti-Lea, Warm Autoantibody	1
Anti-C, Unidentified Antibody	1
Anti-C, Warm Autoantibody	2
Anti-Ch, Anti-Fya	1
Anti-Cw, Anti-E, Anti-K, Anti-S, Anti-Jkb, Warm Autoantibody	1
Anti-D, Anti-G	2
Anti-E, Anti-c	2
Anti-E, Anti-c, Anti-Cw, Anti-S, Unidentified Antibody	1
Anti-E, Anti-c, Anti-Fya	1
Anti-E, Anti-c, Anti-Jka, Warm Autoantibody	1
Anti-E, Anti-c, Anti-Jkb, Warm Autoantibody, Cold Agglutinin	1
Anti-E, Anti-c, Anti-K, Warm Autoantibody	1
Anti-E, Anti-c, Anti-K, Warm Autoantibody, Unidentified Antibody	1
Anti-E, Anti-c, Anti-M, Warm Autoantibody	1
Anti-E, Anti-c, Anti-S, Anti-Jka, Warm Autoantibody	1
Anti-E, Anti-Fya, Warm Autoantibody	2
Anti-e, Anti-Jka, Warm Autoantibody, Unidentified Antibody	1
Anti-E, Anti-Jkb, Unidentified Antibody	1
Anti-E, Anti-K, Anti-Jka, Anti-Lua	1
Anti-E, Anti-K, Anti-Jka, Warm Autoantibody	1
Anti-E, Anti-K, Anti-Jka, Warm Autoantibody, Unidentified Antibody	1
Anti-E, Anti-K, Anti-Lua	1
Anti-e, Anti-K, Anti-M	1
Anti-E, Anti-K, Cold Agglutinin	1
Anti-E, Anti-K, Warm Autoantibody	1
Anti-e, Anti-P1	1
Anti-E, Anti-S, Anti-Kpa	1
Anti-E, Anti-S, Unidentified Antibody	1
Anti-E, Anti-Wra, Warm Autoantibody	1

Combination Antibodies	Serology
Anti-e, Cold Agglutinin	1
Anti-E, Unidentified Antibody	1
Anti-E, Warm Autoantibody	8
Anti-e, Warm Autoantibody	2
Anti-Fya, Warm Autoantibody	1
Anti-Fya, Warm Autoantibody	1
Anti-Fyb, Anti-Jka, Unidentified Antibody	1
Anti-Fyb, Warm Autoantibody	1
Anti-Ge2, Unidentified Antibody	1
Anti-hrS, Anti-Jkb, Warm Autoantibody	1
Anti-Jka, Unidentified Antibody	1
Anti-Jkb, Warm Autoantibody	1
Anti-K, Anti-S, Anti-Fya, Anti-Jkb, Warm Autoantibody	1
Anti-K, Anti-S, Warm Autoantibody, Antibody to an HLA related antigen	1
Anti-K, Anti-V	1
Anti-K, Unidentified Antibody	2
Anti-Kpa, Warm Autoantibody	2
Anti-Lea, Anti-Leb	1
Anti-Lea, Cold Agglutinin	1
Anti-Lua, Anti-Wra, Unidentified Antibody	1
Anti-M, Anti-S	1
Anti-M, Warm Autoantibody	1
Anti-S, Anti-Fyb, Anti-Lua	1
Anti-S, Anti-Fyb, Warm Autoantibody	1
Anti-S, Anti-Jka	1
Anti-S, Anti-Jka, Warm Autoantibody, Cold Agglutinin	1
Anti-S, Unidentified Antibody	1
Anti-S, Warm Autoantibody, Cold Agglutinin, Unidentified Antibody	1
Anti-Wra, Unidentified Antibody	1
Autoantibody, Cold Agglutinin	1
Cold Agglutinin, Unidentified Antibody	1
Warm Autoantibody, Cold Agglutinin	11
Warm Autoantibody, Unidentified Antibody	5

FETAL GENOTYPING

Canadian Blood Services in BC refers specimens for fetal blood group genotyping on prenatal 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 patient has an antibody capable of causing hemolytic disease of the fetus/newborn (HDFN), AND
- The partner 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 2021

Patient	Perinatal Antibody	Predicted Fetal Phenotype	Follow-up Required
1	Anti-D, Anti-G	D+	Yes
2	Anti-K	K+	Yes
3	Anti-D	D+	Yes
4	Anti-K	K-	No
5	Anti-D	D+	Yes
6	Anti-K	K+	Yes
7	Anti-K	N/A	Not required. Pt. had IUT
8	Anti-E	E+	Yes
9	Anti-D	D+	Yes
10	Anti-D, C	D-C-	No
11	Anti-E, Anti-c	E-c-	No
12	Anti-E	E+	Yes
13	Anti-E	E+	Yes
14	ant-D, Anti-P1	D-	No
15	Anti-D, Ant-C	D+	Yes
16	Anti-K	K+	Yes
17	Anti-E	E+	Yes

Patient	Perinatal Antibody	Predicted Fetal Phenotype	Follow-up Required
18	Anti-K	N/A	Sample thawed in transit. Repeat sample not collected, too close to delivery.
19	Anti-D	D+	Yes
20	Anti-E, Anti-c	E- c-	No

Table 8b: Fetal Genotyping Results Totals 2021

Year	2021
Total samples sent	**25**
# of patients tested	**20**
# of patients not requiring MFM follow-up. (Fetus tested negative for the corresponding antigen)	**5**

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 2021, 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

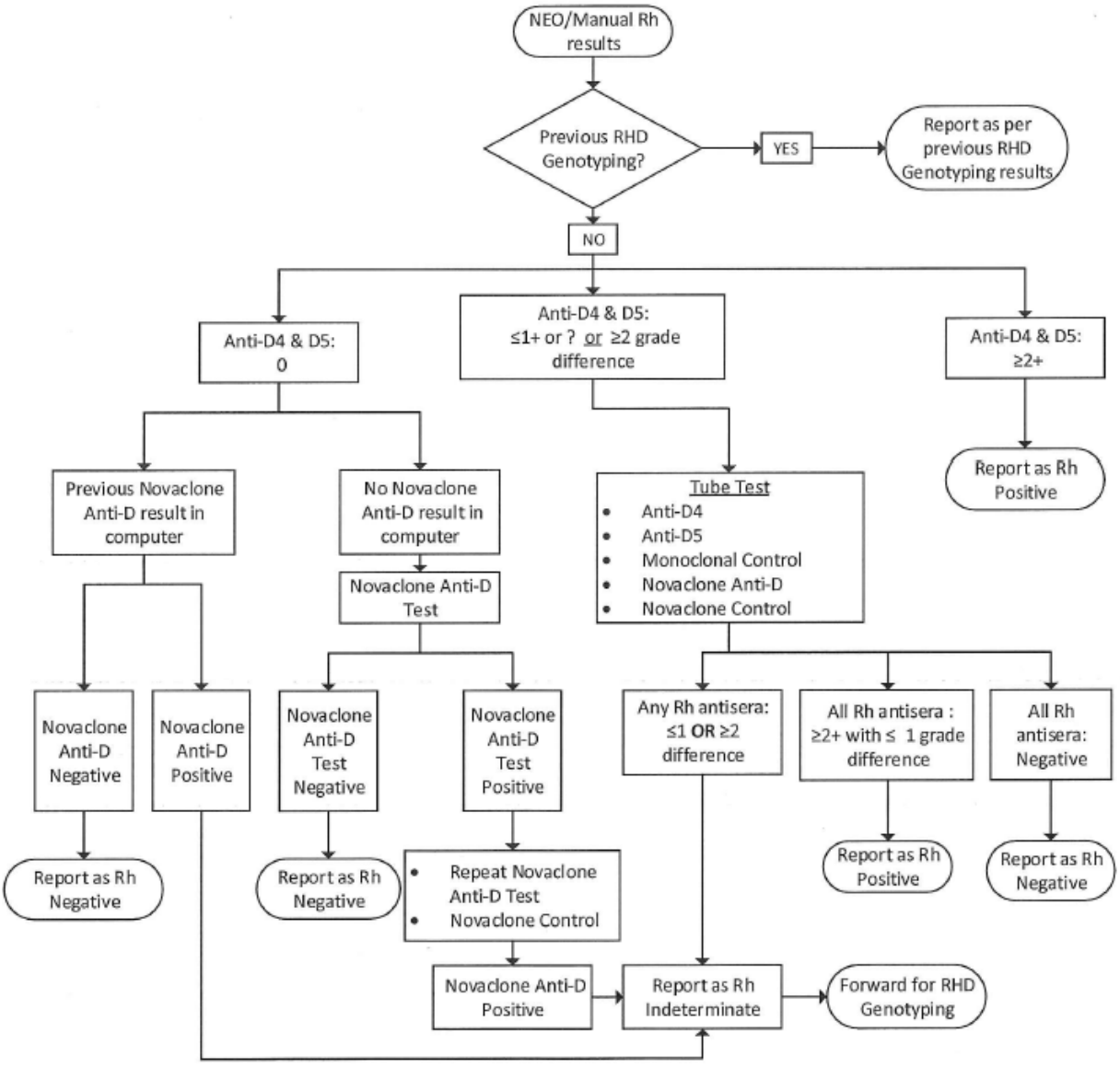


Table 9: Patient # - RHD Type/Result 2021

# of Patients	RHD Genotype	Predicted Phenotype	RHD Sequencing	Rh(D) Group
6	DAR	D variant	NO	NEG
1	DAU2	D Variant	NO	NEG
1	DAU4 or DV type 5	D Variant	NO	NEG
1	DAU6	D variant	NO	NEG
1	DFR or DFR3	Partial D	NO	NEG
1	DHMi	D Variant	NO	Neg
1	DOL or DOL2	D Variant	NO	NEG
1	DVI	D Variant	NO	NEG
15	Possible D	D Positive	NO	POS
30	Weak D type 1	Weak D	NO	POS
19	Weak D type 2	Weak D	NO	POS
11	Weak D type 3	Weak D	NO	POS
13	Weak D type 4.0 or 4.3	Weak D	NO	Neg
1	Weak D type 4.1	Weak D	NO	NEG
1	RHD Deletion and a Weak D Type 96	Weak D	YES	NEG
3	Normal D	D Positive	NO	POS
106	**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". When none of the variants present on the array are detected, the software will produce a result of "Possible D". Prior to 2018, Canadian Blood Services recommended that patients with a result of "Possible D" be treated as Rh negative. However, based on clinical experience at that time, the reporting was changed in 2018 such that patients with a result of "Possible D" were reported as Rh Positive. Categorization of "Possible D" individuals is under continuing review as more experience is gained with the assay, and sequencing to resolve difficult cases becomes more readily available.

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

	2019	2020	2021
Rh Positive	106	114	78
Rh Negative	24	30	28
Total # samples tested	130	144	106

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 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 – Routine Perinatal Specimens

Turnaround Time (TAT)	2017	2018	2019	2020	2020
% of Specimens Tested within 72 hours	88%	91%	88%	89%	89%
% of Specimens Tested > 72 hours	12%	9%	12%	11%	11%

Figure 8: Perinatal Routine TAT

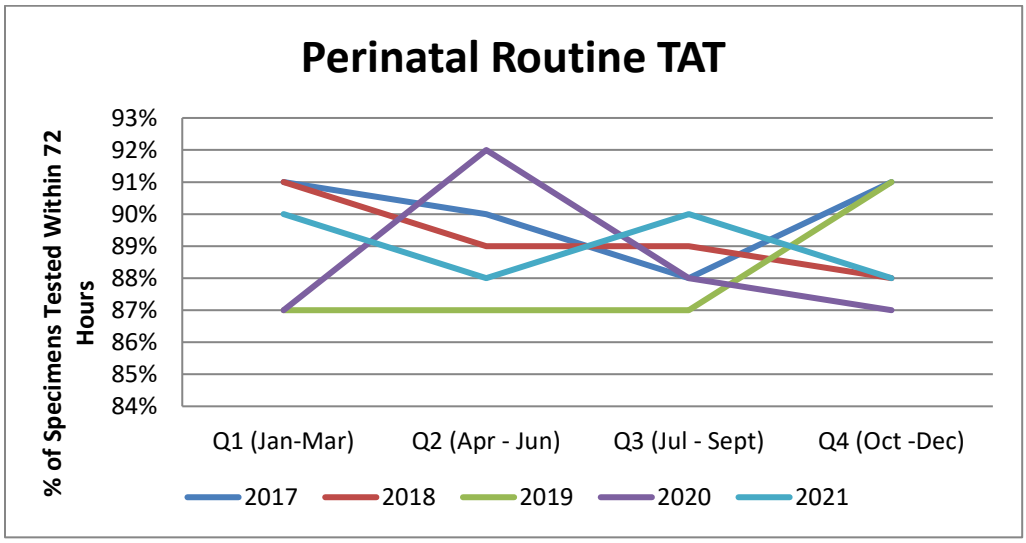
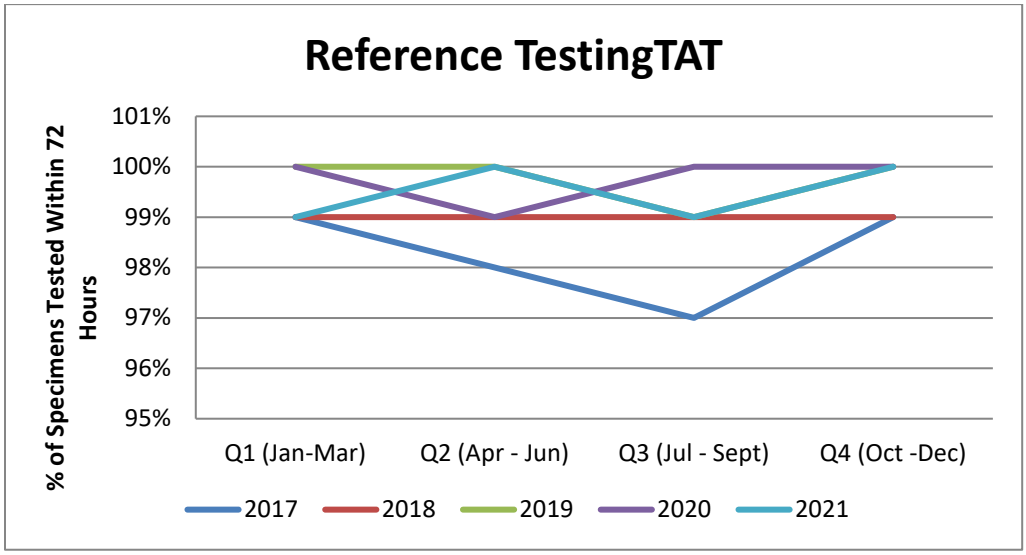


Table 13: Reference TAT

Turn Around Time (TAT)	2017	2018	2019	2020	2021
% of Specimens Tested within 72 hours	98%	99%	100%	100%	99%
% of Specimens Tested > 72 hours	2%	1%	0%	0%	1%

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 14: Quarterly Rejection Rates – Perinatal Specimens 2021

Rejection Category	Q1 (Jan-Mar)	Q2 (Apr - Jun)	Q3 (Jul - Sept)	Q4 (Oct -Dec)
Requisition	22	16	1	21
Specimen	148	104	71	93
Discrepancies Between Requisition & Specimen	16	0	2	1
Discrepancies Between Current Requisition & Historical Records	0	0	0	0
Other (Duplicates, etc.)	2	3	8	5
Total # specimens rejected	188	123	82	120
Total # specimens received	20242	18298	17191	18565
Rejections as a % of total	**0.9%**	**0.7%**	**0.5%**	**0.6%**

Figure 10: Perinatal Rejection Reasons 2021

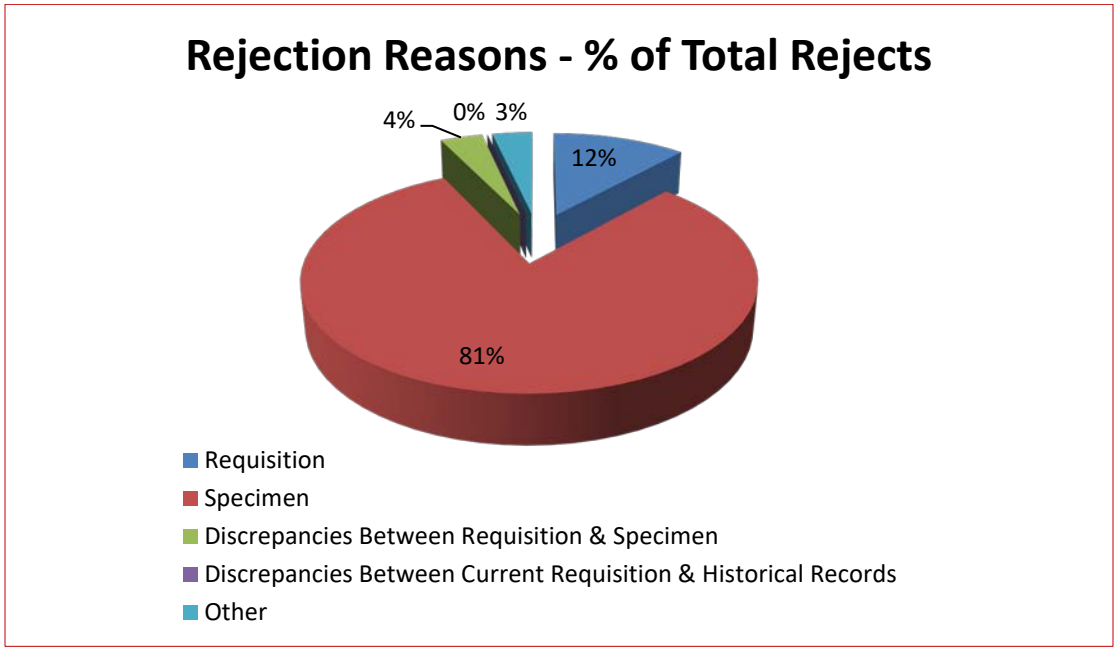
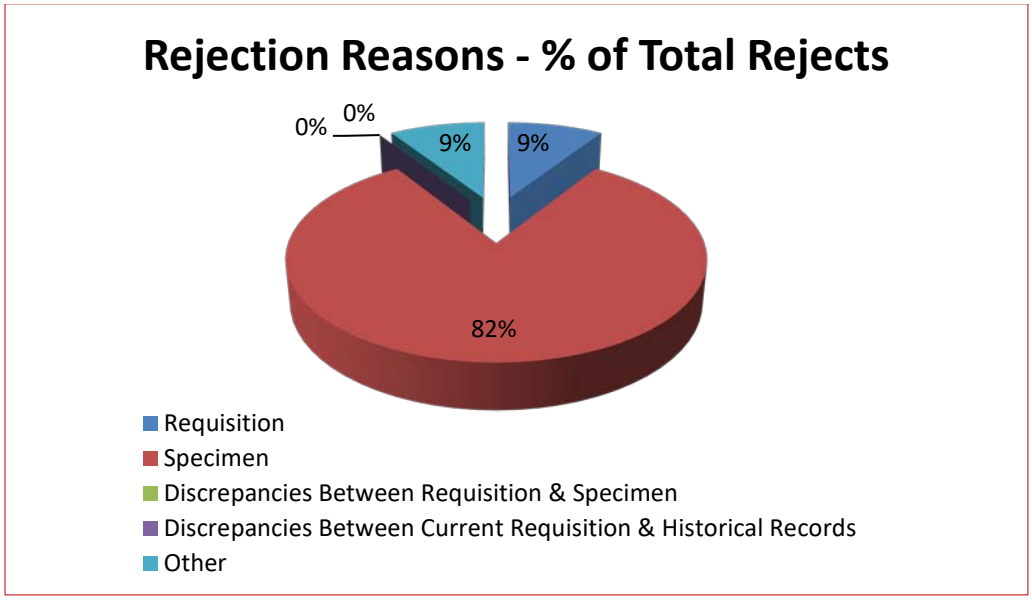


Table 15: Quarterly Rejection Rates – Reference Specimens 2021

Rejection Category	Q1 (Jan-Mar)	Q2 (Apr - Jun)	Q3 (Jul - Sept)	Q4 (Oct -Dec)
Requisition	0	0	0	1
Specimen	3	2	0	4
Discrepancies Between Requisition & Specimen	0	0	0	0
Discrepancies Between Current Requisition & Historical Records	0	0	0	0
Other (Duplicates, etc.)	0	0	1	0
Total # specimens rejected	3	2	1	5
Total # specimens received	163	145	90	125
Rejections as a % of total	1.8%	1.4%	1.1%	4.0%

Figure 11: Reference Rejection Reasons 2021



DIAGNOSTIC SERVICES UPDATE 2021

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

ALL	NEO Iris Analyzer implemented April to June 2021. Eight NEO Instruments in Diagnostic Services were replaced with the next generation NEO IRIS instrument. NEO Iris performs ABO/RH and antibody testing. • Edmonton- 2 NEO Iris' implemented May 2021 • Vancouver- 2 NEO Iris' implemented April and May 2021 • Winnipeg- 3 NEO Iris' implemented May and June 2021, with a fourth to be installed at CBS St.B satellite site in 2022"
Edmonton	Edmonton DS obtained the CPSA 4-year accreditation on 20021-02-25.
Edmonton	Transfer of HEA and RHCE genotype testing to Brampton, 2021-10-01
Vancouver	Awarded CAP Accreditation Dec 2021.
Vancouver	CPSBC – DAP ISO 15189 Audit. ISO 15189 accreditation pending final acceptance.
Winnipeg	Preparation for implementation of the Canadian Blood Services satellite Lab at St Boniface Hospital in March 2022. The Lab will act as a contingency site for services delivered by Winnipeg Diagnostic Services.
Winnipeg	Implementation of equipment in NPIRL – Multisizer 3 (cell counter) and thermocyclers

Winnipeg	Management of supplies, inventory and testing to ensure provision of services are not impacted during supply chain issues experienced in a pandemic.
Winnipeg	eTraceLine environments (perinatal and Crossmatch) were merged to allow better efficiency and ease of use for the labs noe that staff are cross trained.
Winnipeg	Project to implement HistoTrac and replace the access database currently used as the LIS began in Winnipeg in 2021. Projected implementation is December 2022.

Presentations / Abstracts / Publications Listing

Lhevinne Ciurcovich, Lynnette Beaudin, Arianne Fuellos, Balkar Gill, Ilona Resz, Debra Lane, Judith Hannon, Gwen Clarke, Melanie Bodnar. **Comparison of Manual SIAT vs Automated Solid Phase Methodology for Perinatal Antibody Titration**. Poster, CSTM 2021

Lhevinne Ciurcovich[1], Sarah Manfredi[2], Sarah Buchko[2], Darlene Mueller[2], Michelle Wong[2], Mohammad Bahmanyar[2], MatthewYan[1], Gwen Clarke[1]. **Anti-Ina Implicated in Hemolytic Disease of the Fetus and Newborn in an Indigenous Woman.** Poster, CSTM 2021

1: Canadian Blood Services, BC and Yukon Centre

2: Fraser Health Authority, British Columbia

Lhevinne Ciurcovich, Gwen Clarke, Matthew Yan. **A Case of ABO Chimerism in a Perinatal Patient.** Poster, CSTM 2021

Lhevinne Ciurcovich. **Cell-Free Fetal DNA Testing: Advantages, Challenges and Limitations.** Presentation: Virtual Conference, 22nd Annual Education Day on Blood Transfusion Issues, 2021-09-24.

Lhevinne Ciurcovich. **Immunohematology Case Studies.** Presentation: Immucor ImmuTECH Education Day (Virtual) 2021-05-05.
Lynnette Beaudin, Dr. Lani Lieberman MD, FRCP, **Fetal and neonatal alloimmune thrombocytopenia (FNAIT): Diagnosis, Investigation and Treatment.** Presentation: U of T Monthly Transfusion Rounds (Virtual) 2021-02-25
Bodnar M, Hannaford K, Montemayor-Garcia C, ***Hannon J.*** **Blindspots in Immucor BioArray RHD Molecular BeadChip Test: A Review of Cases at Canadian Blood Services Referred Out for RHD Gene Sequencing.** Poster/Abstract, CSTM 2021
Floch A, Vege S, Berardi P, ***Hannon J****, Ochoa-Garay G, Lomas-Francis C, et al.* **A change in RHD is associated with aberrant transcription and very weak D phenotype**. Transfusion 2021
Flegel WA, Bodnar M, Clarke G, ***Hannon J****, Lieberman L.,* **'What constitutes the most cautious approach for a pregnant person with weak D type 4.0?'** Letter to the Editor, *CMAJ June* 2021