Canadian Blood Services

BLOOD
PLASMA
STEM CELLS
ORGANS
& TISSUES

DIAGNOSTIC SERVICES

British Columbia / Yukon

YEAR IN REVIEW

JANUARY – DECEMBER 2022

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

FIGURES

TABLES

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.

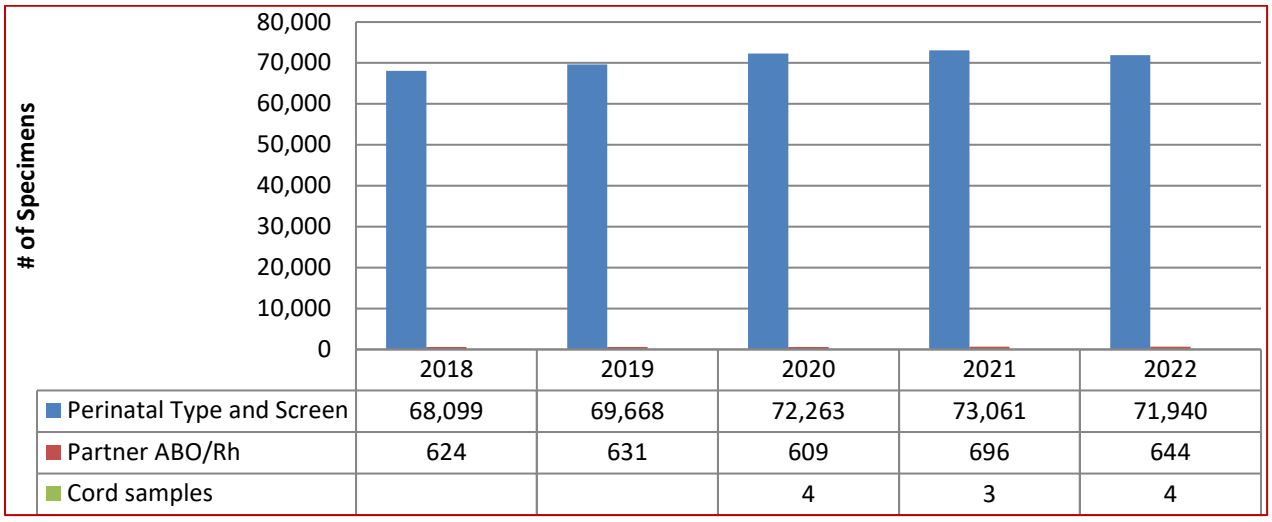
C. Specimens Tested

The data includes all women tested, including referrals.

Table 1: Perinatal Specimens Tested

Specimen Type	Test Type	2018	2019	2020	2021	2022
Maternal	Maternal-Type and Screen	68,099	69,668	72,263	73,061	71,940
Paternal	Paternal-ABO/Rh	624	631	609	696	644
Cord samples	ABO/Rh	Not reported	Not reported	4	3	4
Total # of Specimens Tested		67,899	68,723	70,299	72,876	73, 760
Total # of Patients Tested		**62,063**	**64,992**	**60,677**	**59,891**	**58,965**

Figure 1: Total Perinatal Specimens Tested



D. Antibodies Identified

In 2022, a total of 459 antibodies were reported (see *Table 2*). This is more than 2021. Three hundred and fifty-four women (354) had antibodies identified during their pregnancies (decreased from 357 women in 20202), of these; 268 women had clinically significant antibodies, 97 had clinically insignificant antibodies and 61 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 65% 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 14 of the clinically significant antibodies increased from non-critical to critical levels during the pregnancy with a total of 31 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 (Including Passive D) – (Current Year) 2022					
Clinically Significant Antibodies	**2018**	**2019**	**2020**	**2021**	**2022**
Anti-D	48	39	54	41	75
Anti-C	26	11	11	8	9
Anti-C^{w}	0	2	3	1	2
Anti-Ce	0	0	0	1	1
Anti-c	65	26	27	30	24
Anti-E	150	80	72	60	74
Anti-e	4	6	4	5	7
Anti-G	6	7	7	6	8
Anti-K	70	55	38	37	20
Anti-Kp^{a}	2	0	0	0	0
Anti-Lu^{b}	2	0	0	0	0
Anti-M*	52	37	38	35	27
Anti-S	13	11	10	9	13
Anti-s	0	0	0	1	0
Anti-U	2	0	0	0	0
Anti-Fya	12	7	4	3	4
Anti-Fyb	3	1	2	1	2
Anti-Jka	28	17	16	19	15
Anti-Jkb	4	8	6	8	8
Anti-Jk3	0	2	1	0	0
Anti-Vw	0	0	0	0	0
Anti-Wra	4	4	2	1	2
Anti-Jra	0	0	0	0	0
Anti-Ina	0	0	0	0	1
Anti-Inb	0	0	0	0	0
Anti-Sc1	0	0	1	1	0

Maternal Antibodies Identified (Including Passive D) – (Current Year) 2022					
Clinically Significant Antibodies	**2018**	**2019**	**2020**	**2021**	**2022**
Anti-Lua	2	0	1	0	1
Anti-Cob	0	1	0	0	0
Anti-Dantu	0	1	2	0	1
Anti-Joa	1	0	0	0	0
Anti-Mur	1	0	1	1	1
Anti-PP1Pk	1	0	0	0	0
Anti-Yta	2	0	0	0	0
Anti-Lu14	0	0	2	1	0
Anti-Dia	0	0	2	0	0
Anti-Mit	0	0	1	0	0
Total	**498**	**315**	**300**	**268**	**295**

*Anti-M – IgG antibody component detected

Maternal Antibodies Identified (Including Passive D) – (Current Year) 2022					
Clinically Insignificant Antibodies	**2018**	**2019**	**2020**	**2021**	**2022**
Anti-A1	9	9	15	12	19
Anti-Lea	20	7	11	5	7
Anti-Leb	3	5	4	4	5
Anti-N	1	0	2	3	
Anti-P1	2	6	6	10	6
Anti-Sda	0	0		0	
Antibody to an HLA related antigen	Not reported	Not reported	5	0	2
Cold Agglutinin	Not reported	Not reported	11	9	6
Warm autoantibody	Not reported	Not reported	44	32	43
Unidentified antibody	Not reported	Not reported	54	51	76
Antibody of Undertermined Significance (new category created in 2022)	N/A	N/A	N/A	N/A	40
Passive Anti-D *(not included in totals)*	588	687	719	594	624
TOTAL: Clinically Insignificant Antibodies	**35**	**27**	**38**	**126**	**164**

Table 3: Perinatal Patient Antibody Titres 2022

Antibody	Critical Level	Non-Critical Level	Non-Critical to Critical
Anti-C	2	6	
Anti-c		15	2
Anti-Ce		2	
Anti-CG		1	
Anti-Cw		3	
Anti-D	11	65	6
Anti-DC	1		
Anti-DG	2	3	
Anti-E	6	63	4
Anti-e		5	
Anti-Ec	2	4	
Anti-Fya	1	4	1
Anti-Fyb		2	
Anti-G		1	
Anti-Jka		15	
Anti-Jkb		8	
Anti-M*	1	26	1
Anti-S	1	10	
Anti-s		2	
Anti-Wra	3	2	
Unidentified	1	2	

*Anti-IgG titre

Figure 2: Total Number of Perinatal Antibodies 2022

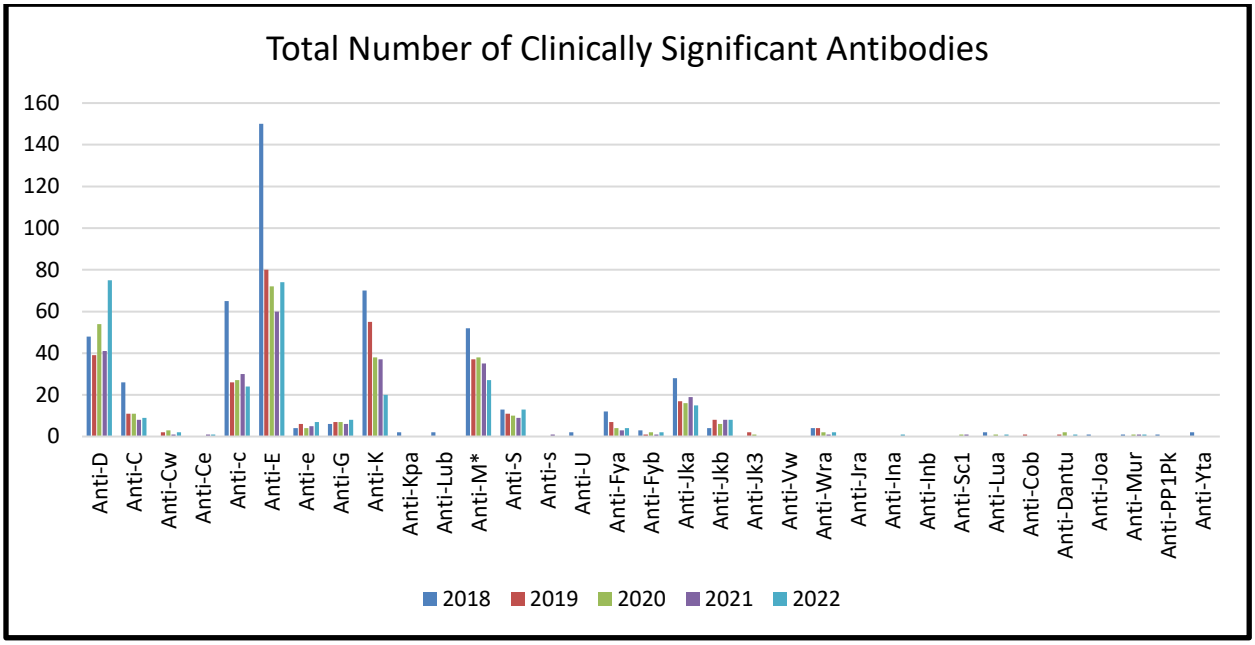


Figure 3: Frequency of Clinically Significant Antibodies 2022

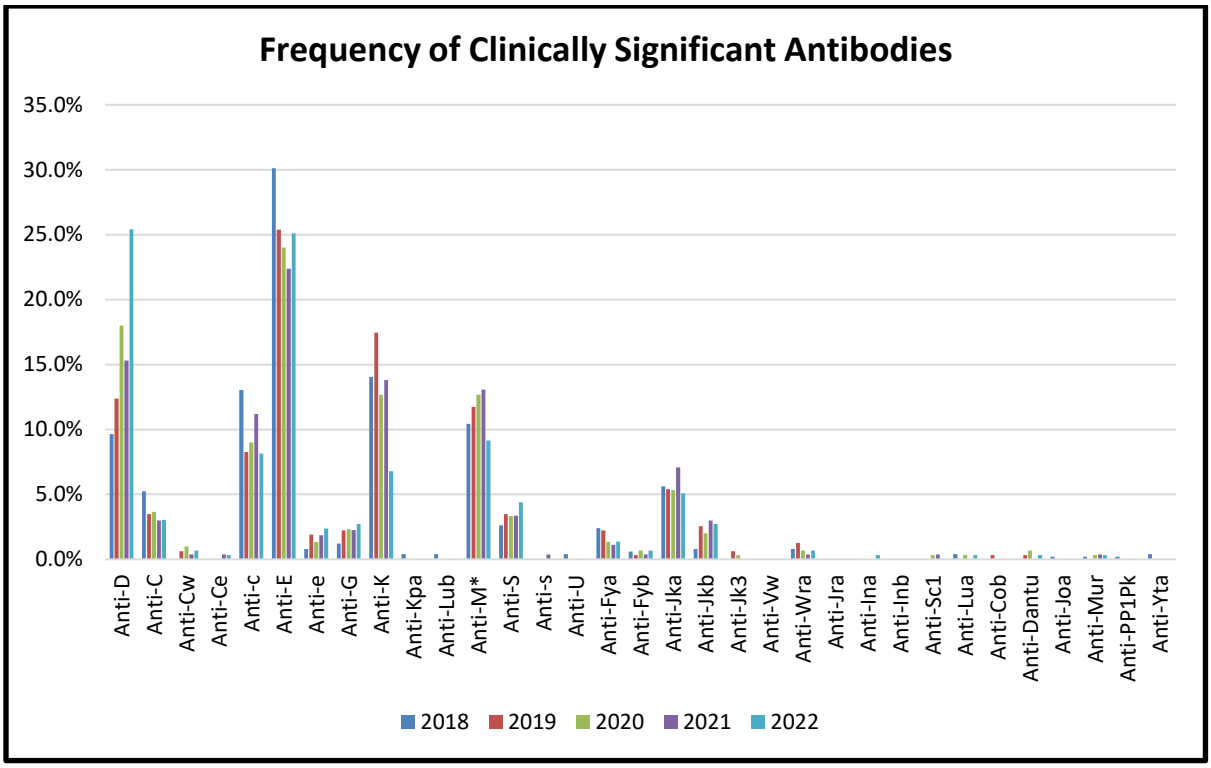


Table 4: Combination Prenatal Antibodies 2022

Combination Antibodies	Prenatal
Anti-A1 Antibody of Undetermined Significance	1
Anti-C Anti-D	2
Anti-c Anti-E	9
Anti-c Anti-E Anti-K	1
Anti-C Anti-e Unidentified Antibody	1
Anti-C Anti-G Unidentified Antibody	1
Anti-C Anti-K Unidentified Antibody	1
Anti-c Unidentified Antibody	1
Anti-Ce Anti-e Unidentified Antibody	1
Anti-Cw Anti-E Anti-Wra Unidentified Antibody	1
Anti-D Anti-G	4
Anti-D Anti-G Unidentified Antibody	2
Anti-D Anti-M	1
Anti-D Anti-P1 Cold Agglutinin Unidentified Antibody	1
Anti-D Anti-P1 Unidentified Antibody	1
Anti-D Anti-S	1
Anti-D Unidentified Antibody	2
Anti-e Anti-Fya Anti-Jkb	1
Anti-E Anti-Jka	1
Anti-E Anti-K	1
Anti-E Anti-K Warm Autoantibody	1
Anti-e Unidentified Antibody	2
Anti-E Unidentified Antibody	2
Anti-Fya Anti-Jkb	1
Anti-Fyb Anti-Jka Unidentified Antibody	1
Anti-G Unidentified Antibody	1
Anti-Jka Unidentified Antibody	1
Anti-Jkb Warm Autoantibody Unidentified Antibody	1
Anti-K Anti-Lea	1
Anti-K Unidentified Antibody	1
Anti-Lea Anti-Leb Anti-Wra	1
Anti-Leb Unidentified Antibody	1
Anti-M Anti-Dantu Unidentified Antibody	1
Anti-M Unidentified Antibody	2
Anti-Mur Unidentified Antibody	1
Anti-s Anti-E	1

Combination Antibodies	Prenatal
Anti-S Unidentified Antibody	1
Anti-S Warm Autoantibody	2
Unidentified Antibody Antibody of Undetermined Significance	1
Warm Autoantibody Cold Agglutinin	1
Warm Autoantibody Cold Agglutinin Unidentified Antibody	1
Warm Autoantibody Unidentified Antibody	2

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 2022, hospitals have referred 472 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 are the primary antibody identification methods. Gel IAT testing may also be used.

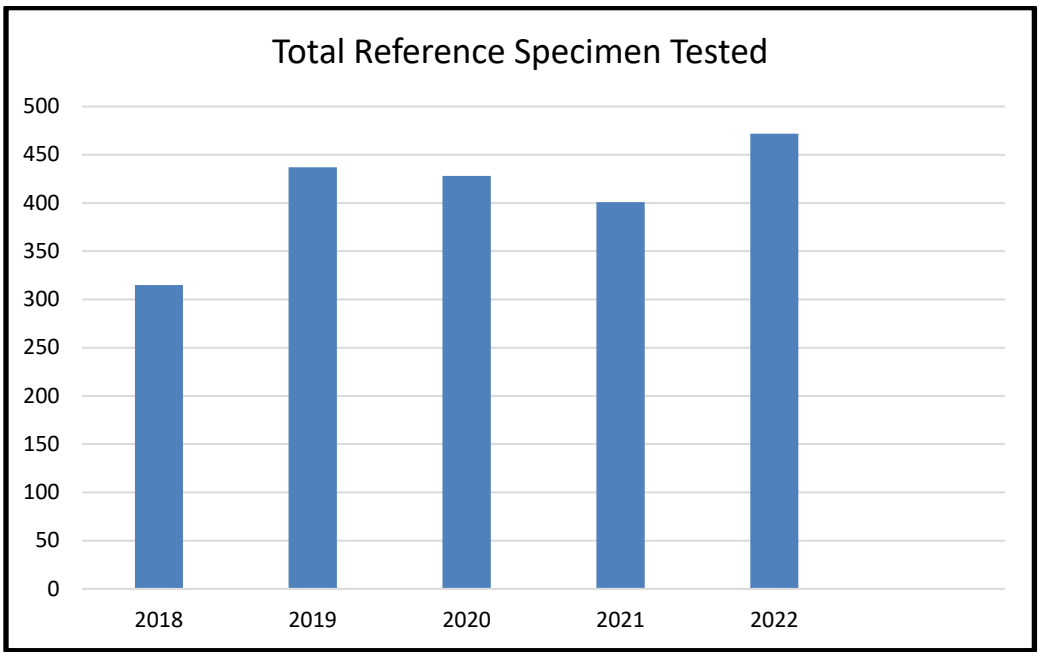
B. Specimens Tested

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	2018	2019	2020	2021	2022
Total Reference Antibody Investigations	315	437	428	401	472

Figure 4: Total Reference Specimens Tested



C. Antibodies Identified

In 2022, a total of 452 antibodies were reported (see *Table 6*). The total number of antibodies detected is higher than 2021, and the distribution of the most common antibodies remains consistent. Two hundred and eighty-four (284) patients had antibodies identified; of these, one hundred and two (102) 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-C, anti-E, anti-c and anti-K, (see *Figure 5*) which together represented 23% 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) – 2022					
Antibodies Detected	**2018**	**2019**	**2020**	**2021**	**2022**
Anti-D	15	50	11	6	6
Anti-A1	9	2		2	2
Anti-C	21	10	19	12	17
Anti-c	20	13	12	13	17
Anti-Ce				0	
Anti-Ch			1	2	
Anti-Cob			1	0	
Anti-C^w	3	2	7	2	2
Anti-Dantu		1		0	1
Anti-Dia			1	0	
Anti-E	40	42	40	40	35
Anti-e	6	7	2	9	6
Anti-f		1		0	
Anti-Fya	15	12	8	10	7
Anti-Fyb	2	3	3	6	1
Anti-Fy3			1	0	
Anti-G	11	7	7	6	9
Anti-Ge2				1	
Anti-Ge3					1
Anti-hrS				1	
Anti-Ina				0	
Anti-Inb				0	
Anti-Jk3	3	1	1	0	
Anti-Jka	10	10	14	11	14
Anti-Jkb	6	3	2	6	4
Anti-JMH			1	0	

Reference Antibodies Identified (Including Passive D) – 2022					
Antibodies Detected	**2018**	**2019**	**2020**	**2021**	**2022**
Anti-Jra			1	0	1
Anti-K	26	23	26	23	31
Anti-k	1		1	0	
Anti-Kna					1
Anti-Kp^a	1	1	5	3	3
Anti-Kpb	1			0	
Anti-Lea	20	2	3	3	3
Anti-Leb	3	1	2	1	1
Anti-Lua		2	1	5	1
Anti-Lub		2		0	1
Anti-Lu14			1	0	
Anti-LW			1	0	1
Anti-M	10	6	11	6	4
Anti-McCd/ Anti-Vil		1	2	0	
Anti-Mia	2			2	6
Anti-Mur	1			1	1
Anti-N	1	1	1	0	2
Anti-P1	2	2	5	1	7
Anti-S	9	6	8	16	9
Anti-s				0	1
Anti-Sc1				0	
Anti-Sda	0	2		0	
Anti-U			1	0	1
Anti-V				1	1
Anti-VS					1
Anti-Vel			1	1	
Anti-Vw	1			0	1
Anti-Wra	2	3	4	6	6
Anti-Yka				1	
Anti-Yta				0	1
Antibody to a Low Prevalence Antigen			1	0	
Antibody to a High Prevalence Antigen					1

Reference Antibodies Identified (Including Passive D) – 2022					
Antibodies Detected	**2018**	**2019**	**2020**	**2021**	**2022**
Antibody to an HLA related antigen			1	2	4
Autoantibody			1	1	
Warm autoantibody			131	137	133
Cold Agglutinin			33	36	45
Unidentified antibody			37	44	43
Antibody of Undetermined Significance					1
Panreactive antibody					1
Passive Anti-D	19	22	27	19	18
TOTAL:	**260**	**238**	**436**	**436**	**452**

Figure 5: Total Number of Reference Antibodies

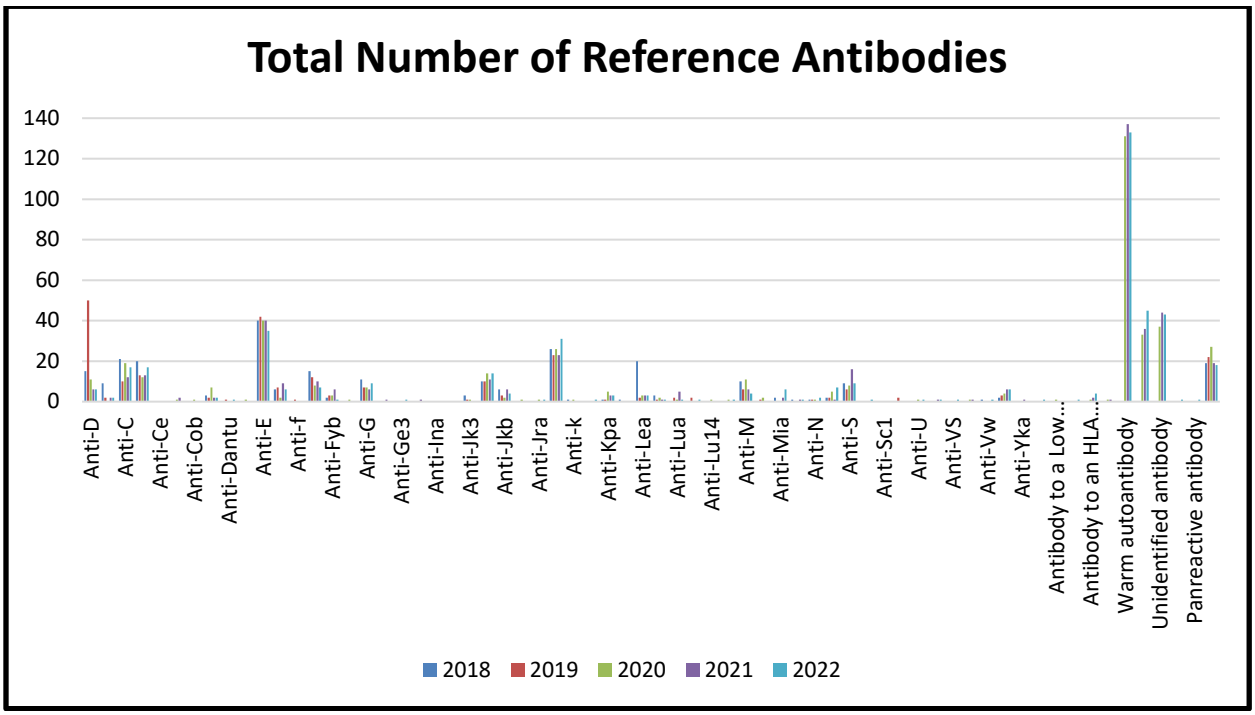


Figure 6: Frequency of Reference Antibodies

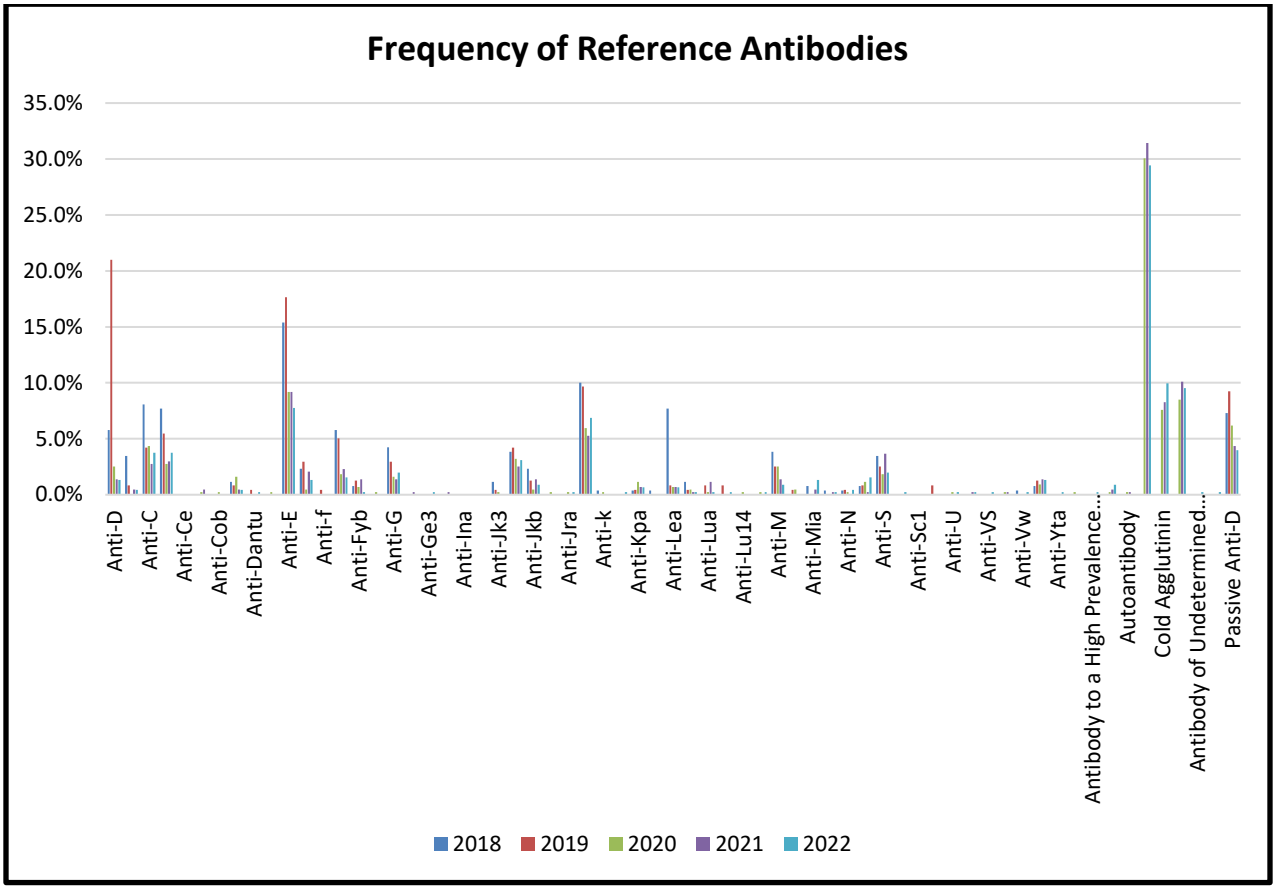


Table 7: Combination Reference Antibodies 2022

Combination Antibodies	Serology
Antibody to a High Prevalence Antigen Warm Autoantibody	1
Anti-C Anti-D Anti-E Unidentified Antibody	1
Anti-C Anti-D Anti-G Unidentified Antibody	1
Anti-c Anti-E	2
Anti-C Anti-e Anti-Jka	1
Anti-c Anti-E Anti-Jka Anti-S Unidentified Antibody	1
Anti-c Anti-E Anti-Jka Warm Autoantibody	1
Anti-C Anti-e Anti-K	1
Anti-C Anti-e Anti-K Warm Autoantibody	1
Anti-c Anti-E Anti-S	1
Anti-c Anti-E Anti-S Anti-Jka	1
Anti-c Anti-E Warm Autoantibody	1
Anti-c Anti-E Warm Autoantibody Cold Agglutinin	1

Combination Antibodies	Serology
Anti-C Anti-Fya Anti-Jka	1
Anti-C Anti-G	3
Anti-C Anti-G Anti-S	1
Anti-c Anti-Jka	1
Anti-c Anti-K Anti-Fya	1
Anti-C Anti-K Anti-Fya Unidentified Antibody	1
Anti-C Anti-K Warm Autoantibody	1
Anti-C Anti-K Warm Autoantibody Cold Agglutinin	1
Anti-c Unidentified Antibody	3
Anti-C Unidentified Antibody	3
Anti-E Anti-Jka	1
Anti-E Anti-Jka	1
Anti-E Anti-K	1
Anti-E Anti-K	1
Anti-E Anti-K Anti-Jkb	1
Anti-E Anti-K Anti-Lea	1
Anti-E Anti-P1	1
Anti-E Anti-S	1
Anti-E Unidentified Antibody	2
Anti-E Unidentified Antibody	2
Anti-E Warm Autoantibody	11
Anti-E Warm Autoantibody Cold Agglutinin	1
Anti-Fya Anti-Jkb	1
Anti-Fyb Anti-Jkb Warm Autoantibody	1
Anti-Ge3 Unidentified Antibody	1
Anti-Jka Anti-S Warm Autoantibody Cold Agglutinin Unidentified Antibody	1
Anti-Jka Warm Autoantibody	1
Anti-Jka Warm Autoantibody Unidentified Antibody	1
Anti-K Antibody to an HLA related antigen	2
Anti-K Anti-Jka Anti-Lua	1
Anti-K Anti-Jka Anti-Wra	1
Anti-K Anti-Mia	1
Anti-K Cold Agglutinin Unidentified Antibody	1
Anti-K Unidentified Antibody	3
Anti-K Warm Autoantibody	3
Anti-K Warm Autoantibody Cold Agglutinin	1
Anti-Kpa Unidentified Antibody	1

Combination Antibodies	Serology
Anti-Kpa Warm Autoantibody	1
Anti-Mia Anti-Mur	1
Anti-N Anti-s	1
Anti-S Warm Autoantibody	1
Anti-S Warm Autoantibody Cold Agglutinin	1
Anti-U Anti-Lea Anti-Leb	1
Anti-V Anti-VS Anti-Wra	1
Anti-Wra Cold Agglutinin	2
Cold Agglutinin Unidentified Antibody	2
Unidentified Antibody Panreactive antibody	1
Warm Autoantibody Cold Agglutinin	13

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 2022

Patient	Maternal Antibody	Predicted Fetal Phenotype	Follow-up Required
1	AntiD, Anti-G	D+	Yes
2	Anti-D	D+	Yes
3	Anti-E, anti-c	E-c-	No
4	Anti-D, anti-E, anti-M	E+, D+	Yes
5	Anti-E, anti-c, anti-K, anti-Jka	c+	Yes
6	Anti-K, anti-Jkb	K+	Yes
7	Anti-K	K indeterminate	Yes
8	Anti-E, anti-c	E+ c indeterminate (X2)	Yes
9	Anti-D	D+	Yes
10	Anti-D	D+	Yes
11	Anti-D	D-	No
12	Anti-c	c+	Yes
13	Anti-E	E-	No
14	Anti -D	D+	Yes
15	Anti-E	E+	Yes
16	Anti-D	D+	Yes

Table 8b: Fetal Genotyping Results Totals 2022

Year	2022
Total samples sent	**17**
# of patients tested	**16**
# of patients not requiring MFM follow-up. (Fetus tested negative for the corresponding antigen)	**3**

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 2022, 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

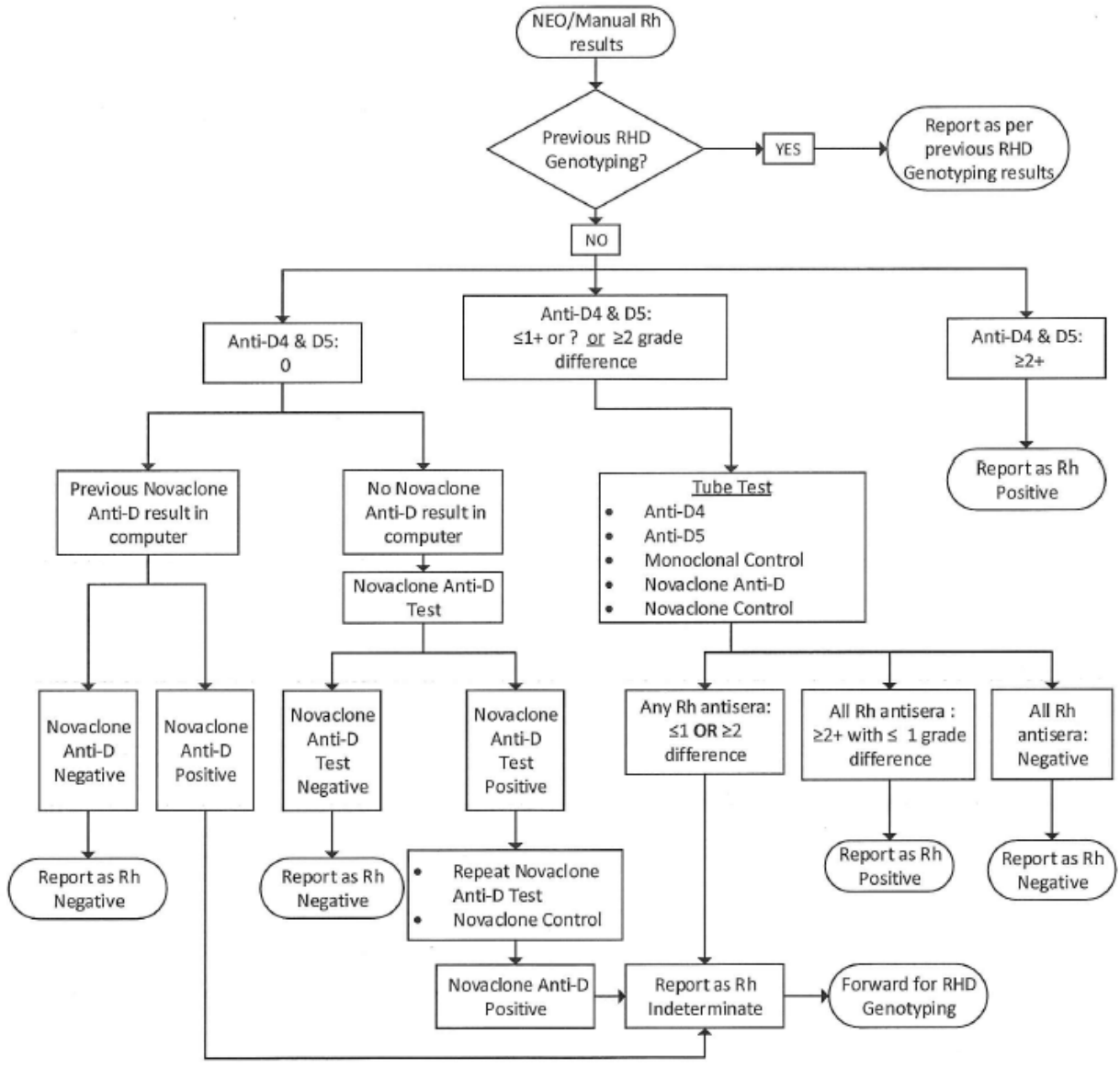


Table 9: Patient # - RHD Type/Result 2022

# of Patients	RHD Genotype	Predicted Phenotype	RHD Sequencing	Rh(D) Group
1	C in trans to D (Ceppelini effect)	DCe/dCe	YES	POS
5	DAR	D variant	NO	NEG
1	DHMi	D variant	NO	NEG
1	DNB	D variant	NO	NEG
4	No RHD variants detected (see comment)	N/A	NO	NEG
1	RHD Deletion	RHD Deletion	NO	NEG
2	RHD Deletion	D variant	YES	NEG
3	RHD Deletion and DVII.1	Partial D	Yes	NEG
2	RHD Deletion and RHD*DVII.1	Partial D	Yes	NEG
1	RHD Deletion and Weak D type 91	Weak D	YES	NEG
1	RHD Deletion and Weak D type 150	Partial D	YES	NEG
1	RHD Deletion and Weak D type 42	Partial D	YES	NEG
1	RHD Deletion and partial RHD*DVII.1	Partial D	YES	NEG
1	RHD Deletion and partial RHD*DVII.1	Partial D	Yes	NEG
17	Weak D type 1	Weak D	NO	POS
10	Weak D type 2	Weak D	NO	POS
15	Weak D type 3	Weak D	NO	POS
9	Weak D type 4.0 or 4.3	Weak D	NO	NEG
76	**TOTAL**			

Possible D = Rh neg (prior to 2018-04-16).

Possible D = Rh pos (after 2018-04-16).

RHD result of "Possible D" will now be reported as "No RHD variants detected" and recommend to treat as Rh negative per cBS medical as of 2022-10-12

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

	2019	2020	2021	2022
Rh Positive	106	114	78	43
Rh Negative	24	30	28	33
Total # samples tested	130	144	106	76

Note: Data not captured prior to 2019

The Diagnostic Services Lab in Edmonton receives samples for *RHD* genotyping from across Canada (excluding Quebec). The assay, Immucor's BioArray Molecular BeadChip™ Test, is a targeted assay designed to detect the most common variants of the *RHD* gene. Interrogating 35 genetic markers, the assay can make 68 variant allele calls. The most common variant *RHD* alleles detected are *weak D type 1, weak D type 2*, and *weak D type 3*. Individuals carrying these alleles can be safely treated as RhD positive as it has been established that they will not form alloanti-D. Current national and international guidelines recommend that patients with any other weak or partial D genotype should be treated as RhD negative although it must be recognized that the alloimmunization potential of many of these weak D variants is uncertain.

When none of the interrogated allele variants are detected, the assay returns a result of "Possible D". Based on the findings of a quality assurance study of "Possible D" samples sent for *RH* Next Generation Sequencing (NGS), a change was made to the interpretation and reporting of results for the *RHD* genotyping assay. As of October 2022, all prenatal patients with weak or discrepant RhD serologic phenotype whose genotyping results show no detectable *RHD* variants will be interpreted as RhD negative with the recommendation that they be considered Rh immune globulin (RhIG) eligible.

The testing and reporting strategy for hemoglobinopathy patients is different. Current guidelines recommend that all hemoglobinopathy patients who serologically test as RhD positive should have *RHD* genotyping performed in conjunction with extended red cell antigen genotyping that includes an assessment of *RHCE* variants. (At Canadian Blood Services this is performed using Progenika's ID Core XT assay). In the absence of weak or discrepant D serologic phenotype or unexplained genetic markers in the assay results, these patients will be interpreted as RhD positive when no *RHD* variants are detected by the Immucor BioArray Molecular BeadChip™ Test. Samples with discordant serologic findings or unexplained assay results may be referred out for *RH* gene sequencing.

The field of blood group genomics has expanded significantly over the past five years with the identification of an ever-increasing number of new *RHD* alleles and increased recognition of the remarkable *RH* genetic diversity across different ethnic groups. To better reflect the limitations of this targeted assay in the ethnically diverse Canadian population, samples returning a result of "possible D" will be reported as "No *RHD* variants detected". In all cases, the results of *RHD* genotyping must be correlated with the serologic findings and clinical context of the patient. Medical consultation is available at CBS reference labs to assist with result interpretation and the need for additional testing will be assessed on a case-by-case basis.

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)	2018	2019	2020	2021	2022
% of Specimens Tested within 72 hours	89%	88%	89%	89%	90%
% of Specimens Tested > 72 hours	11%	12%	12%	11%	10%

Figure 8: Perinatal Routine TAT

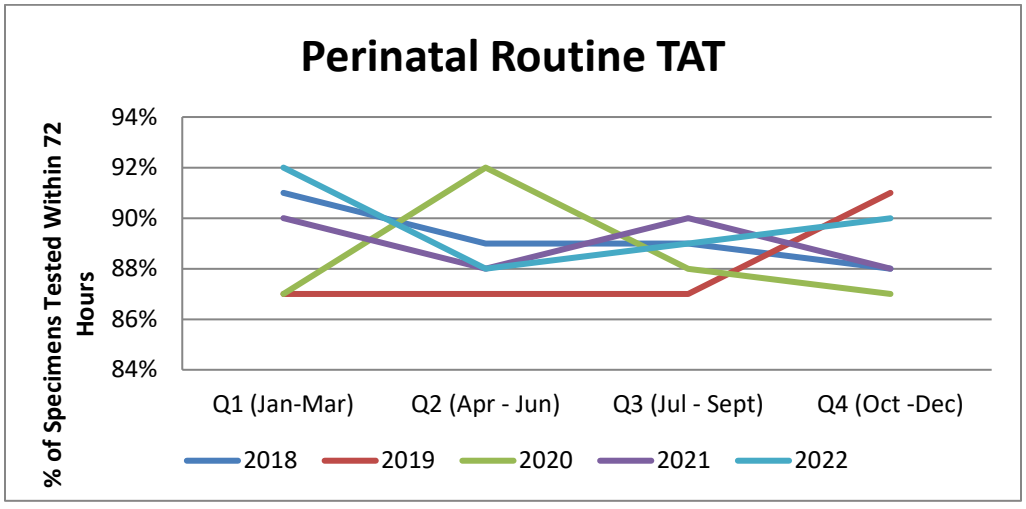
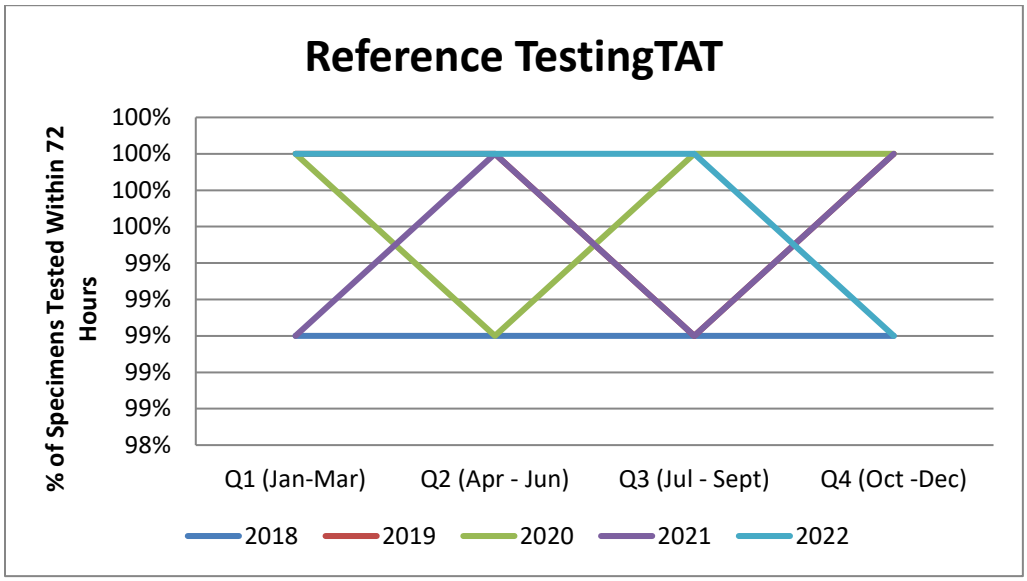


Table 13: Reference TAT

Turn Around Time (TAT)	2018	2019	2020	2021	2022
% of Specimens Tested within 72 hours	99%	100%	100%	100%	99%
% of Specimens Tested > 72 hours	1%	0%	0%	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 14: Quarterly Rejection Rates – Perinatal Specimens 2022

Rejection Category	Q1 (Jan-Mar)	Q2 (Apr - Jun)	Q3 (Jul - Sept)	Q4 (Oct -Dec)
Requisition	0	8	27	14
Specimen	104	102	132	151
Discrepancies Between Requisition & Specimen	4	2	0	0
Discrepancies Between Current Requisition & Historical Records	0	0	0	0
Other (Duplicates, etc.)	5	7	4	3
Total # specimens rejected	113	119	163	168
Total # specimens received	18380	17787	17786	18010
Rejections as a % of total	**0.9%**	**0.7%**	**0.5%**	**0.6%**

Figure 10: Perinatal Rejection Reasons 2022

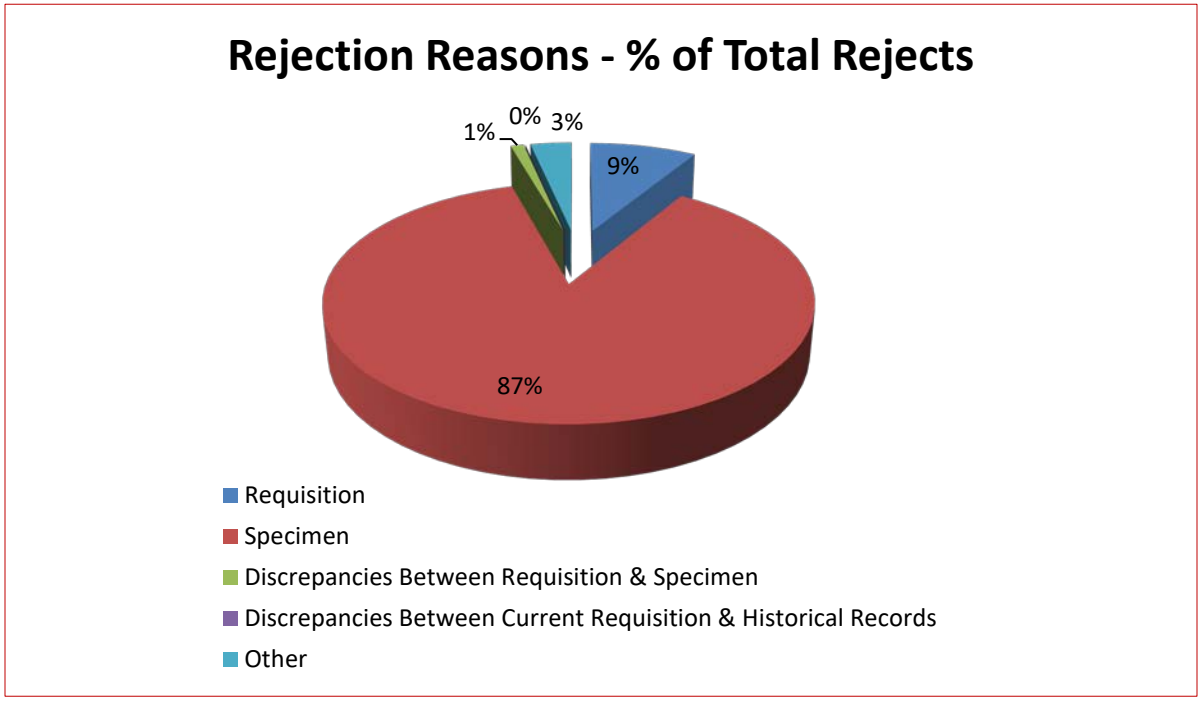


Table 15: Quarterly Rejection Rates – Reference Specimens 2022

Rejection Category	Q1 (Jan-Mar)	Q2 (Apr - Jun)	Q3 (Jul - Sept)	Q4 (Oct -Dec)
Requisition	1	2	2	0
Specimen	0	1	1	2
Discrepancies Between Requisition & Specimen	0	1	1	0
Discrepancies Between Current Requisition & Historical Records	0	0	0	0
Other (Duplicates, etc.)	3	2	0	3
Total # specimens rejected	7	6	4	5
Total # specimens received	152	154	144	115
Rejections as a % of total	**4.6%**	**3.9%**	**2.8%**	**4.3%**

Figure 11: Reference Rejection Reasons 2022