Canadian Blood Services

BLOOD
PLASMA
STEM CELLS
ORGANS
& TISSUES

DIAGNOSTIC SERVICES

MANITOBA

YEAR IN REVIEW

JANUARY – DECEMBER 2020

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 pregnant women for blood type and red blood cell antibodies. Results from this screening assist physicians, midwives and nurse practitioners in ensuring the appropriate management of a pregnancy for both the mother and baby.

A. Testing Performed

Canadian Blood Services Perinatal Laboratory routinely performs the following tests:

- ABO/Rh blood type
- Screen for red blood cell antibodies
- Antibody Identification, if antibodies are detected
- Antibody Identification referrals
- Antibody Titration, if a clinically significant antibody is identified
- Phenotyping
- Fetal Bleed Screening Test
- Kleihauer-Betke Test for Quantitation of fetal-maternal hemorrhage
- Direct Antiglobulin Test for detection of HDFN (Hemolytic Disease of the Fetus/Newborn)
- Bedside testing during fetal cordocentesis

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 suspected fetal hemorrhage).

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

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

Newborns (Cords): Cord blood or neonate specimens must be submitted with the mother's specimen as noted above. ABO/Rh testing is performed on cord or neonatal, when indicated, on specimens submitted to Canadian Blood Services. The direct antiglobulin test is performed if the mother has a clinically significant antibody or on request if the baby shows signs of HDFN (i.e. anemia or jaundice). This is especially important when the mother is Rh negative or when the mother has a clinically significant antibody. If the baby has unexpected anemia or jaundice, assessment of the cord blood sample for blood group and DAT may also be helpful.

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

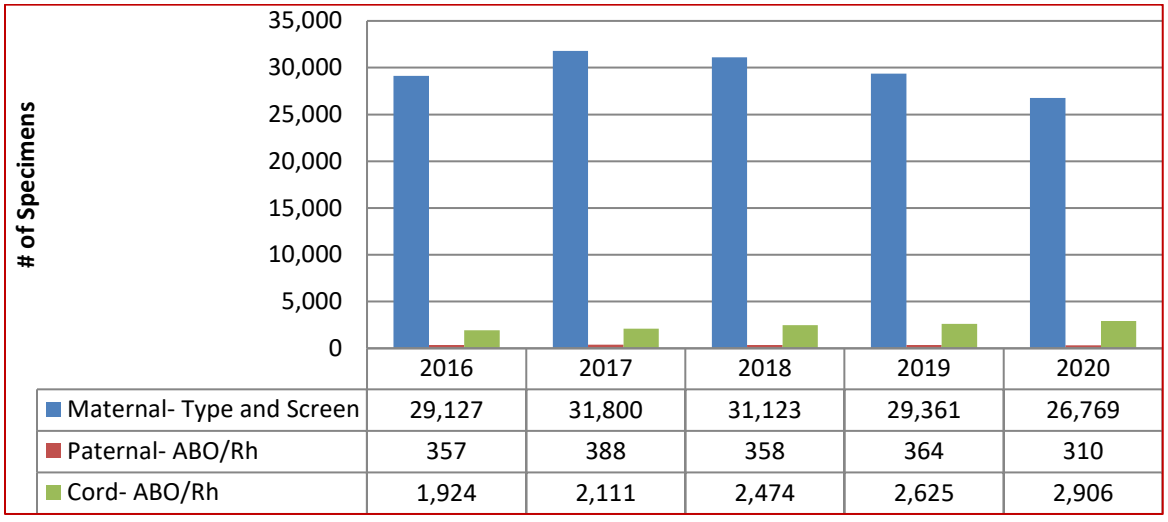
C. **Specimens Tested**

The data includes all women tested, including referral patients from other provincial jurisdictions. The total number of specimens tested has remained stable when compared to the last 4 years as seen in *Table 1* below.

Table 1: Perinatal Specimens Tested

Specimen Type	Test Type	2016	2017	2018	2019	2020
Maternal	Maternal- Type and Screen	29,127	31,800	31,123	29,361	26,769
Paternal	Paternal- ABO/Rh	357	388	358	364	310
Cord- ABO/Rh	Cord- ABO/Rh	1,924	2,111	2,474	2,625	2,906
Total # of Specimens Tested		**31,408**	**34,299**	**33,955**	**32,350**	**29,985**
Total # of Patients Tested		**23,980**	**24,248**	**24,079**	**23,360**	**24,793**

Figure 1: Total Perinatal Specimens Tested



D. Antibodies Identified

In 2020, a total of 221 antibodies were reported (see *Table 2*). This is comparable to 2019 where 222 antibodies were reported. Two hundred and six women had antibodies identified during their pregnancies (slightly decreased from 215 women in 2019). Breakdown of antibodies identified within the 221 women consisted of 212 clinically significant antibodies and 9 clinically insignificant antibodies. Thirty-six women had multiple clinically significant antibodies. Passive anti-D data has been excluded from the preceding numbers.

Antibodies identified were considered clinically significant if they have been reported to cause HDFN. The most common clinically significant antibodies identified were: anti-E, anti-K, anti-D, anti-M (IgG), and anti-Jka,(see *Figure 3*) which together represented 80.7% of the total antibodies identified.

Titres for 9 of the clinically significant antibodies increased from non-critical to critical levels during the pregnancy with a total of 23 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)					
Clinically Significant Antibodies	**2016**	**2017**	**2018**	**2019**	**2020**
Anti-D	12	11	11	16	19
Anti-C	10	9	10	6	10
Anti-C^w	2	2	0	0	0
Anti-Ce	0	0	0	0	1
Anti-ce	0	0	1	0	0
Anti-c	17	20	12	11	6
Anti-E	63	66	64	69	74
Anti-e	5	8	6	6	2
Anti-f	0	0	1	0	0
Anti-G	2	1	2	3	3
Anti-Ge3	0	0	1	0	0
Anti-K	47	56	58	51	43
Anti-Kp^a	1	1	0	1	0
Anti-Kp^b	1	1	0	0	0
Anti Lu^a	1	1	0	0	0
Anti-Lu^b	2	0	0	1	0
Anti-M*	9	18	16	14	18
Anti-S	6	6	7	6	6
Anti-s	1	2	0	1	1
Anti-Fy^a	4	4	4	2	4
Anti-Fy^b	1	4	4	1	2
Anti-Jk^a	17	20	17	13	17
Anti-Jk^b	5	4	4	1	4
Anti-Jk^3	0	1	0	0	0
Anti-Di^a	0	0	1	1	0
Anti-Di^b	0	0	1	1	0
Anti Mi^a	0	0	1	0	0
Anti-V	1	1	1	0	0
Anti-Wr^a	2	2	1	2	2
Total	**209**	**238**	**223**	**206**	**212**

Clinically Insignificant Antibodies	2016	2017	2018	2019	2020
Anti-A_1	0	1	0	0	0
Anti-He	0	1	0	0	0
Anti-JMH	0	1	1	1	0
Anti-Le^a	13	11	17	13	8
Anti-Le^b	2	2	2	1	0
Anti-N	0	2	1	1	0
Anti-P_1	0	3	2	0	1
Passive Anti-D (not included in totals)	738	813	763	665	248
TOTAL: Clinically Insignificant Antibodies	**15**	**21**	**23**	**16**	**9**

Figure 2: Total Number of Perinatal Antibodies

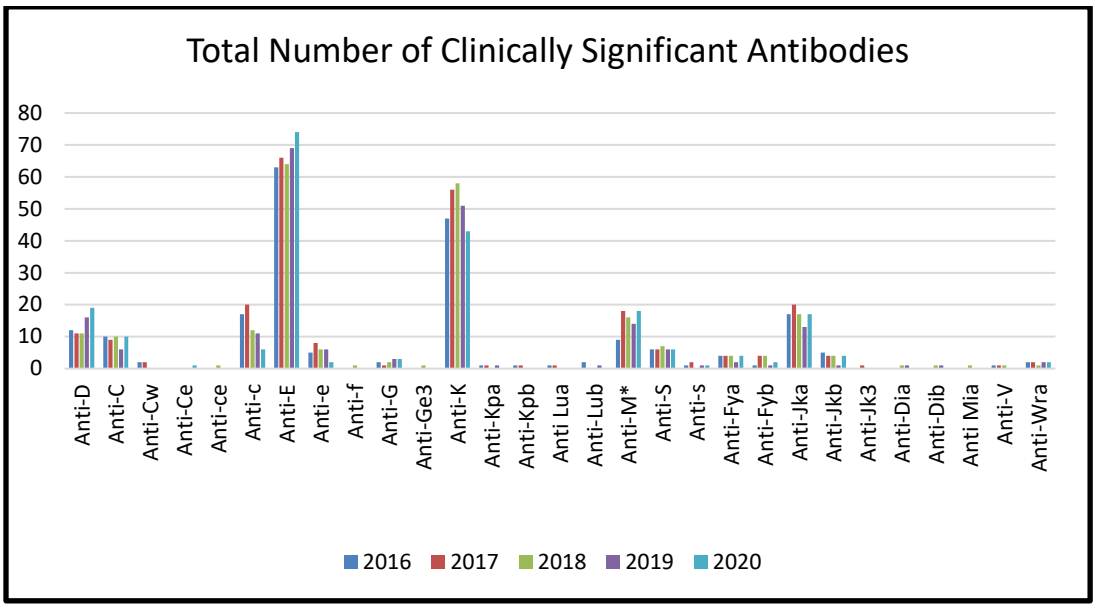


Figure 3: Frequency of Clinically Significant Antibodies

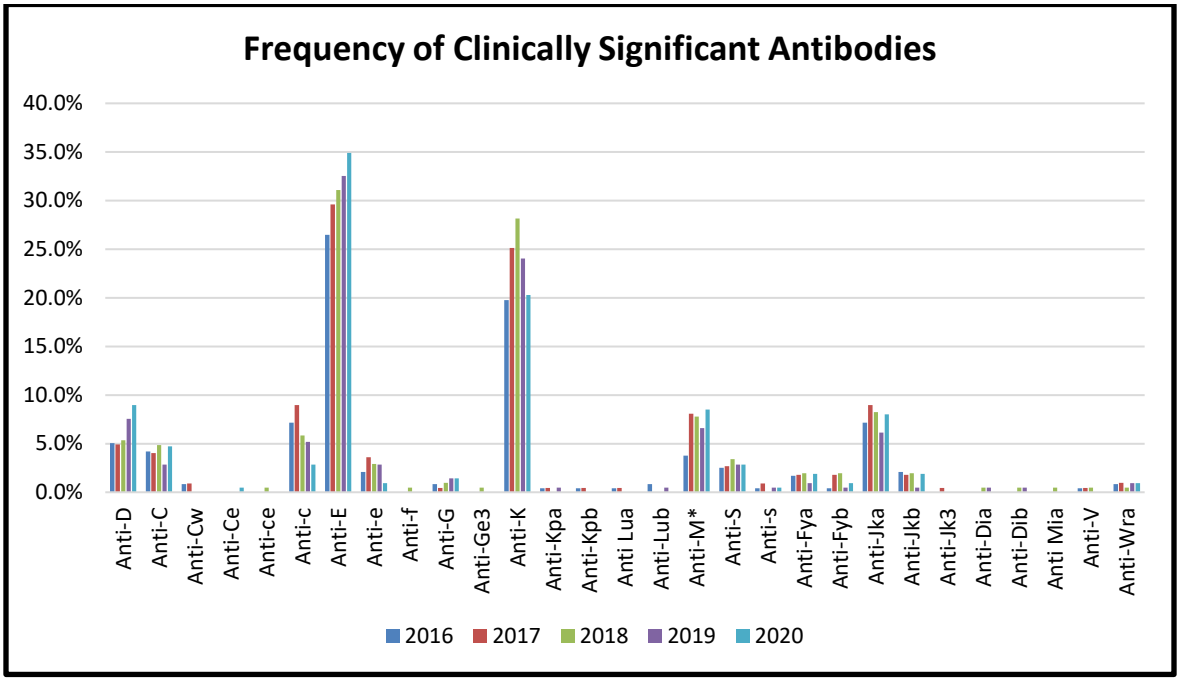


Table 3: Perinatal Patient Antibody Titres 2020

Antibody	Critical Level	Non-Critical Level	Non-Critical to Critical
Anti-D	11	15	4
Anti-C	0	8	0
Anti-E	4	39	1
Anti-c	0	6	0
Anti-e	0	1	0
Anti-DC	0	0	0
Anti-DE	0	0	0
Anti-Ec	3	7	1
Anti-Ce	1	3	1
Anti-G	0	0	0
Anti-DG	2	0	1
Anti-CG	0	0	0
Anti-K*	2	7	0
Anti-Fya	0	3	0
Anti-Fyb	0	2	0
Anti-Jka	0	12	0
Anti-Jkb	0	1	0
Anti-M	0	14	0
Anti-S	0	5	0
Anti-s	0	1	0
Anti-Wra	0	1	1

***Note:** Anti-K is considered critical at any titre. Antibody titres for Kell system antibodies may be performed in Manitoba after consultation with the Medical Officer

Table 4: Perinatal Patient Combination Antibodies 2020

Combination Antibodies	Total
Anti-C, Anti-D	1
Anti-C, Anti-D, Anti-G	1
Anti-C, Anti-D, Anti-Jka	1
Anti-C, Anti-e	2
Anti-c, Anti-E	9
Anti-c, Anti-E, Anti-Jka	1
Anti-C, Anti-K	1
Anti-C, Anti-M, Anti-Wra	1
Anti-D, Anti-C	1
Anti-D, Anti-Fya	1
Anti-D, Anti-G	2
Anti-Dia, Anti-E, Anti-Fyb	1
Anti-E, Anti-Fya	1
Anti-E, Anti-Fyb	1
Anti-E, Anti-Jka	1
Anti-E, Anti-K	2
Anti-E, Anti-Lea	3
Anti-E, Anti-Lea, Anti-Leb	1
Anti-E, Anti-S	1
Anti-E, Anti-Wra	1
Anti-Fya, Anti-Jkb	1
Anti-Jka, Anti-K	1
Anti-Lea, Anti-K	1
Total	36

CROSSMATCH / REFERENCE LABORATORY

The Crossmatch/ Reference Laboratory Winnipeg Red Cell Serology, Diagnostic Services provides centralized transfusion medicine services and testing to approximately 70 hospitals in Manitoba and eastern Nunavut that do not perform these tests. Reference services are provided for 4 rural hospitals with crossmatching laboratories in Manitoba and 12 hospitals in Northwest Ontario. 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 2020, hospitals have referred 225 requests for red cell antibody identification.

Referring hospitals have different capabilities and expertise in resolving red cell antibody investigations.

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 investigation. When a new antibody is identified by the Diagnostic Services laboratory a patient wallet card may be provided.

A. Testing Performed

The Crossmatch/Reference Laboratory routinely performs the following tests:

- ABO/Rh blood type
- Screen for red blood cell antibodies
- Antibody Identification, if antibodies are detected
- Crossmatch, electronic and serological
- Isohemagglutinin Titre
- Phenotyping (patient and donor units)
- Transfusion Reaction Investigation
- Direct Antiglobulin Test
- Elution and Absorption
- Cold Agglutinin Screen
- Thermal Amplitude

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. PEG IAT is also the manual back-up method for antibody screening.

The Crossmatch Laboratory distributes both stock and crossmatched red cell and platelet components to those hospitals which receive all of their transfusion medicine services from Canadian Blood Services.
The Crossmatch Laboratory performs complex antibody investigations and distributes crossmatch compatible (or least incompatible) red cell units.

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).

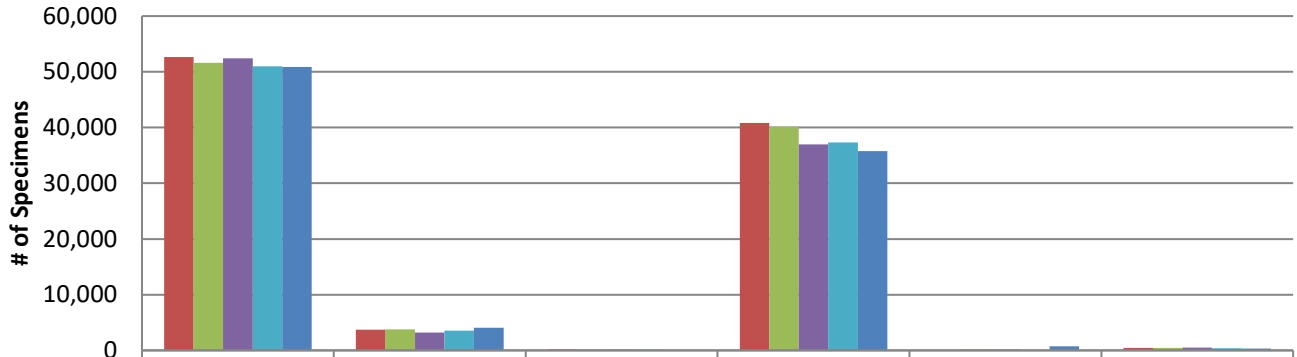
The total number of crossmatch specimens tested has remained fairly consistent over the last 4 years as illustrated in *Table 5* below. The implementation of the Trace Line laboratory information system (LIS) was completed at 16 hospitals in Winnipeg and rural Manitoba in 2015. These hospitals now hold a stock inventory of red blood cell components and perform electronic crossmatch on demand; thus reducing the number of red blood cells issued and reserved for specific patients on hand in the hospital Blood Bank. The number of red blood cell components distributed has stabilized as hospitals appear to have adjusted inventories to optimal levels. As part of Choosing Wisely Canada, a "Just One" campaign that highlighted "Why give two when one will do?" was rolled out in late 2018 at the Winnipeg tertiary care facilities which may have contributed to the reduction in red blood cell utilization.

The spike in number of product transformation is a result of the implementation of Red Cell aliquots in January 2020. The lab will prepare and provide small volume red cell aliquots for neonatal and pediatric transfusion.

Table 5: Crossmatch/Reference Specimens Tested

Specimen Type		2016	2017	2018	2019	2020
	Type and Screen	52,642	51,628	52,395	50,995	50,843
	Antibody Investigations	3,714	3,801	3,232	3,575	4,048
	Transfusion Reactions	193	167	162	136	124
	Blood Components Distributed	40,820	40,125	36,986	37,292	35,783
	Product Transformation	56	193	162	17	761
	Diagnostic Titres	443	446	489	378	329
Test Totals (excluding components distributed)		**57,048**	**56,235**	**56,440**	**55,101**	**56,105**
Patients Tested		**31,200**	**30,553**	**31,025**	**29,528**	**27,617**

Figure 4: Total Crossmatch Specimens Tested



	Type and Screen	Antibody Investigations	Transfusion Reactions	Blood Components Distributed	Product Transformation	Diagnostic Titres
2016	52,642	3,714	193	40,820	56	443
2017	51,628	3,801	167	40,125	193	446
2018	52,395	3,232	162	36,986	162	489
2019	50,995	3,575	136	37,292	17	378
2020	50,843	4,048	124	35,783	761	329

C. Antibodies Identified

In 2020, total of 1044 antibodies clinically significant and insignificant antibodies were reported (see *Table 6*). The distribution of the most common antibodies remains consistent. Five hundred ninety-six patients had antibodies identified, of these; 182 patients had multiple antibodies.

The difference in number of antibodies detected in 2019 and 2020 is a reflective of a process change in reporting made in the lab in February 2020 and may not represent a significant increase in the rate of antibodies being detected. This change in process did not affect the reporting of Perinatal antibodies, therefore the jump in number is not observed in that patient population. Antibodies will continue to be reported in this manner in Winnipeg for the foreseeable future and preliminary numbers suggest that 2021 will show consistency with what is reported in 2020.

Antibodies identified were considered clinically significant if they have been reported to cause acute or delayed hemolytic transfusion reactions. The most common clinically significant antibodies identified were: anti-E, anti-K, anti-D, anti-Jka, anti-c, anti-C, and anti-e, (see *Figure 5*).

Figure 5: Total Number of Crossmatch Antibodies

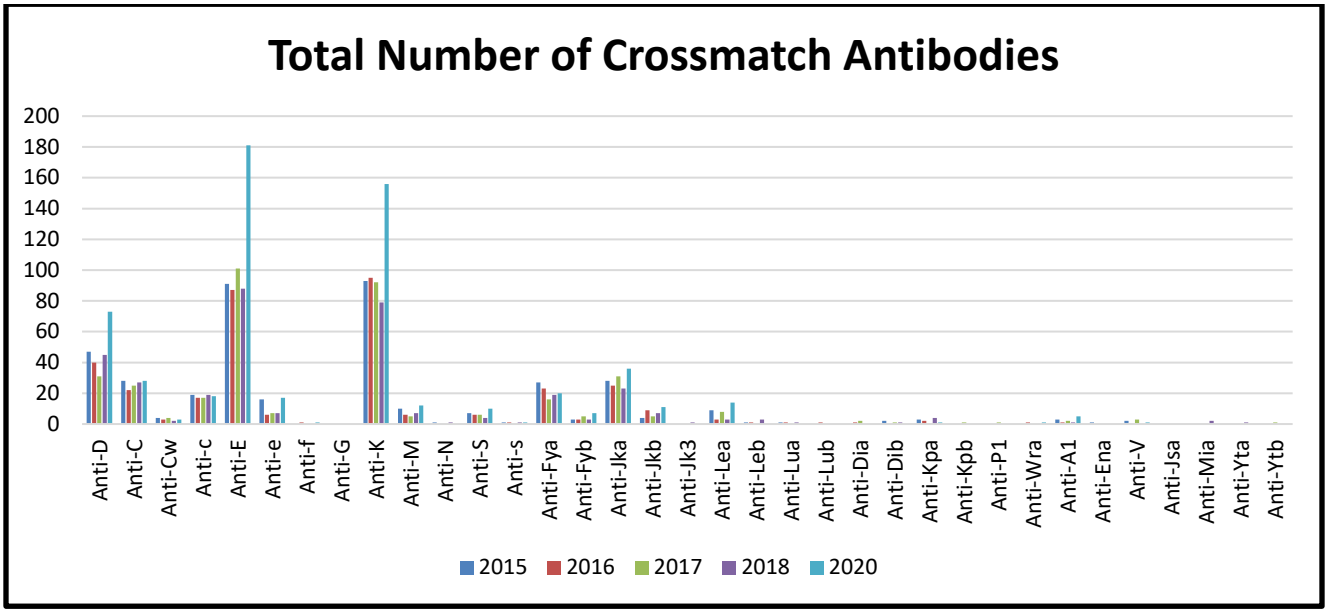
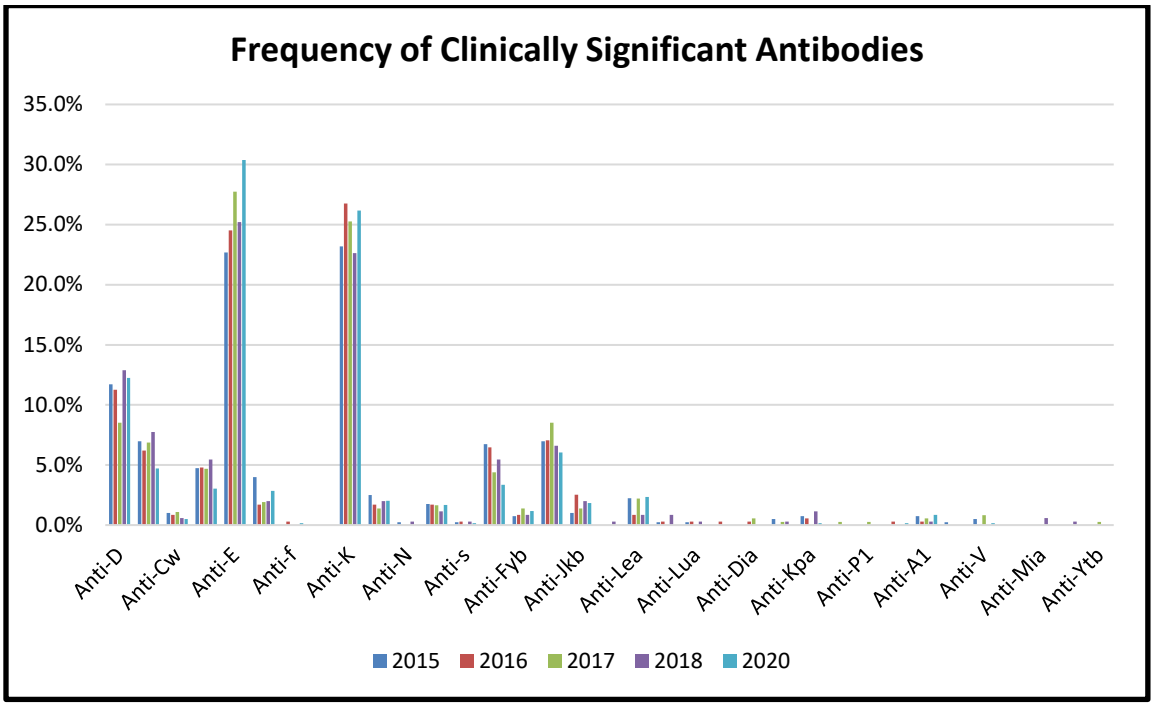


Table 6: Total Number of Crossmatch Antibodies Detected

Reference Antibodies Identified – 2020						
Clinically Significant Antibodies	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Anti-D	47	40	31	45	39	73
Anti-C	28	22	25	27	22	28
Anti-C^w	4	3	4	2	2	3
Anti-c	19	17	17	19	23	18
Anti-E	91	87	101	88	78	180
Anti-e	16	6	7	7	17	17
Anti-f	0	1	0	0	0	1
Anti-G	0	0	0	0	0	0
Anti-K	93	95	92	79	87	156
Anti-M	10	6	5	7	5	12
Anti-N	1	0	0	1	0	0
Anti-S	7	6	6	4	5	10
Anti-s	1	1	0	1	0	1
Anti-Fy^a	27	23	16	19	10	20
Anti-Fy^b	3	3	5	3	0	7
Anti-Jk^a	28	25	31	23	24	36
Anti-Jk^b	4	9	5	7	11	11
Anti-Jk^3	0	0	0	1	0	0
Anti-Le^a	9	3	8	3	12	14
Anti-Le^b	1	1	0	3	1	0
Anti-Lu^a	1	1	0	1	2	0
Anti-Lu^b	0	1	0	0	0	0
Anti-Di^a	0	1	2	0	1	0
Anti-Di^b	2	0	1	1	1	0
Anti-Kp^a	3	2	0	4	1	1
Anti-Kp^b	0	0	1	0	0	0
Anti-P_1	0	0	1	0	0	0
Anti-Wr^a	0	1	0	0	4	1
Anti-A_1	3	1	2	1	1	5
Anti-En^a	1	0	0	0	0	0
Anti-V	2	0	3	0	0	1
Anti-Jsa	0	0	0	0	0	0
Anti-Mia	0	0	0	2	1	0
Anti-Yta	0	0	0	1	0	0
Anti-Ytb	0	0	1	0	0	0
Total	**401**	**355**	**364**	**349**	**347**	**596***

* The difference in number of antibodies detected in 2019 and 2020 is a reflective of a process change in reporting and may not represent a significant increase in the rate of antibodies being detected.

Figure 6: Frequency of Clinically Significant Antibodies 2020



PLATELET IMMUNOLOGY LABORATORY

The Platelet Immunology Laboratory within Diagnostic Services at Canadian Blood Services provides human leukocyte (HLA) and platelet specific (HPA) antigen typing and antibody investigation testing to assist health care providers in the management of thrombocytopenic patients who have become refractory to vital platelet transfusions, patients affected by neonatal alloimmune thrombocytopenia and autoimmune disorders and patients suspected to have had platelet antibody mediated adverse transfusion events such as post transfusion purpura (PTP). The Laboratory also performs testing on patients and donors for the investigation of Transfusion Related Acute Lung Injury (TRALI). The Laboratory provides service to all Manitoba hospitals and is a national reference lab for any hospital in Canada requiring these testing services.
In addition, the Laboratory also performs HLA and HPA typing on blood donors prior to being placed onto a national platelet donor registry. The registry is used to conduct searches to identify suitably compatible donors who can be used for patients that show no benefit from conventional platelet components.

A. Testing Performed

The Platelet Immunology Laboratory routinely performs the following tests:

- HLA Antigen Typing
- HLA Antibody Screen
- HLA Antibody Identification, if antibodies are detected
- HLA Antigen Typing for disease association
- HPA Typing
- HPA Screening
- HPA Antibody Identification, if antibodies are detected
- Platelet Crossmatch
- Selection of HLA/HPA Compatible Donors for Platelet Transfusion

HLA antibody screening and identification is performed using Luminex bead technology. Whereas HPA antibody screening, identification and crossmatching are performed using a solid phase platform, commercial ELISA kits and the MAIPA method.

A combination of Luminex® multiplex technology, Bioarray eMAP® (Elongation-mediated Multiplexed Analysis of Polymorphisms) technology and/or MicroSSP are the primary HLA and HPA genotyping methods utilized for genotyping both patients and donors.

Selection lists of HLA/HPA compatible donors for patients' requiring platelet transfusion support are generated by the Platelet Immunology Lab using the national platelet donor database.

B. Specimens Tested

Table 7 below illustrates the total number of Platelet Immunology specimens tested.

Table 7: Platelet Immunology Specimens Tested

Specimen Type		2015	2016	2017	2018	2019	2020
Donor	HLA Antigen Typing	1,560	1,087	1,171	3,728	1,234	748
	HLA Antibody Screen/Identification	58	41	29	17	10	28
	HPA Antigen Typing	804	528	648	1918	615	337
	HPA Antibody Screen/Identification	19	10	79	9	31	11
Test Totals		**2,441**	**1,666**	**1,927**	**5,672**	**1,890**	**1,124**
Patient	HLA Antigen Typing	1,116	1,392	1,205	1,200	1,198	1,170
	HLA Antibody Screen/Identification	108	144	141	167	117	129
	HPA Antigen Typing	261	302	316	292	286	297
	HPA Antibody Screen/Identification	321	432	437	390	446	489
	Selection of HLA/HPA Selected Platelet Donors	307	369	395	333	289	486
Test Totals		**2,113**	**2,639**	**2,494**	**2,382**	**2,336**	**2,571**

Figure 7: Total Platelet Immunology Donor Specimens Tested

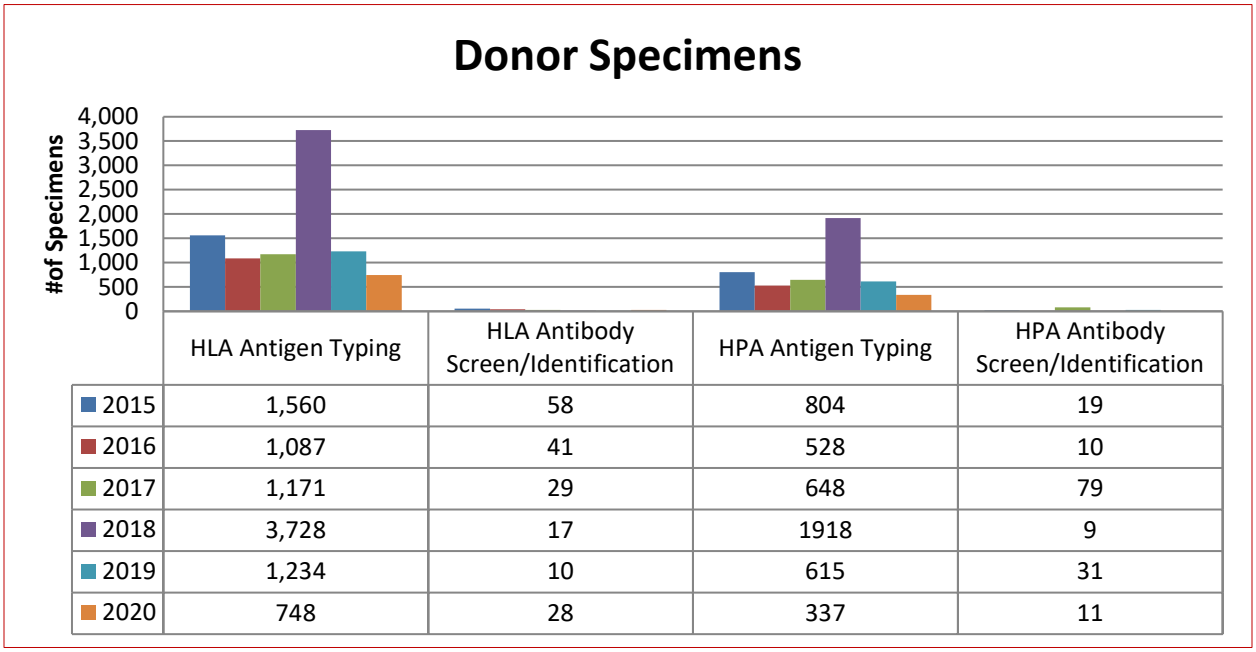
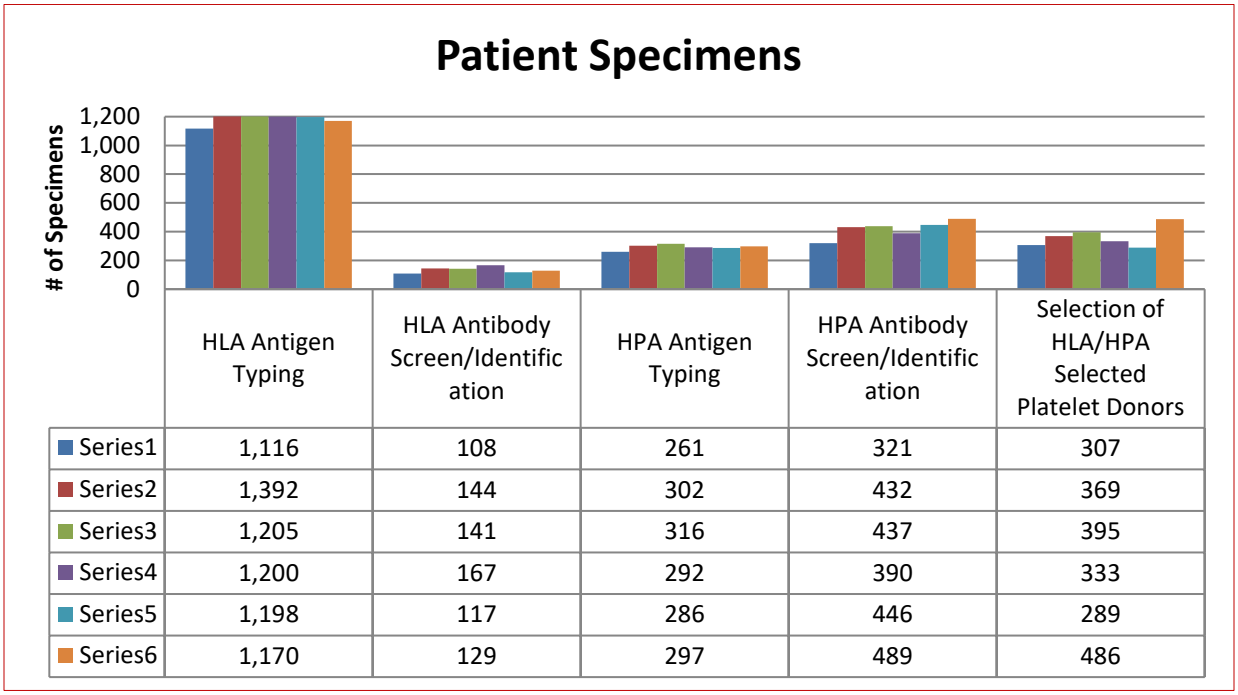


Figure 8: Total Platelet Immunology Patient Specimens Tested



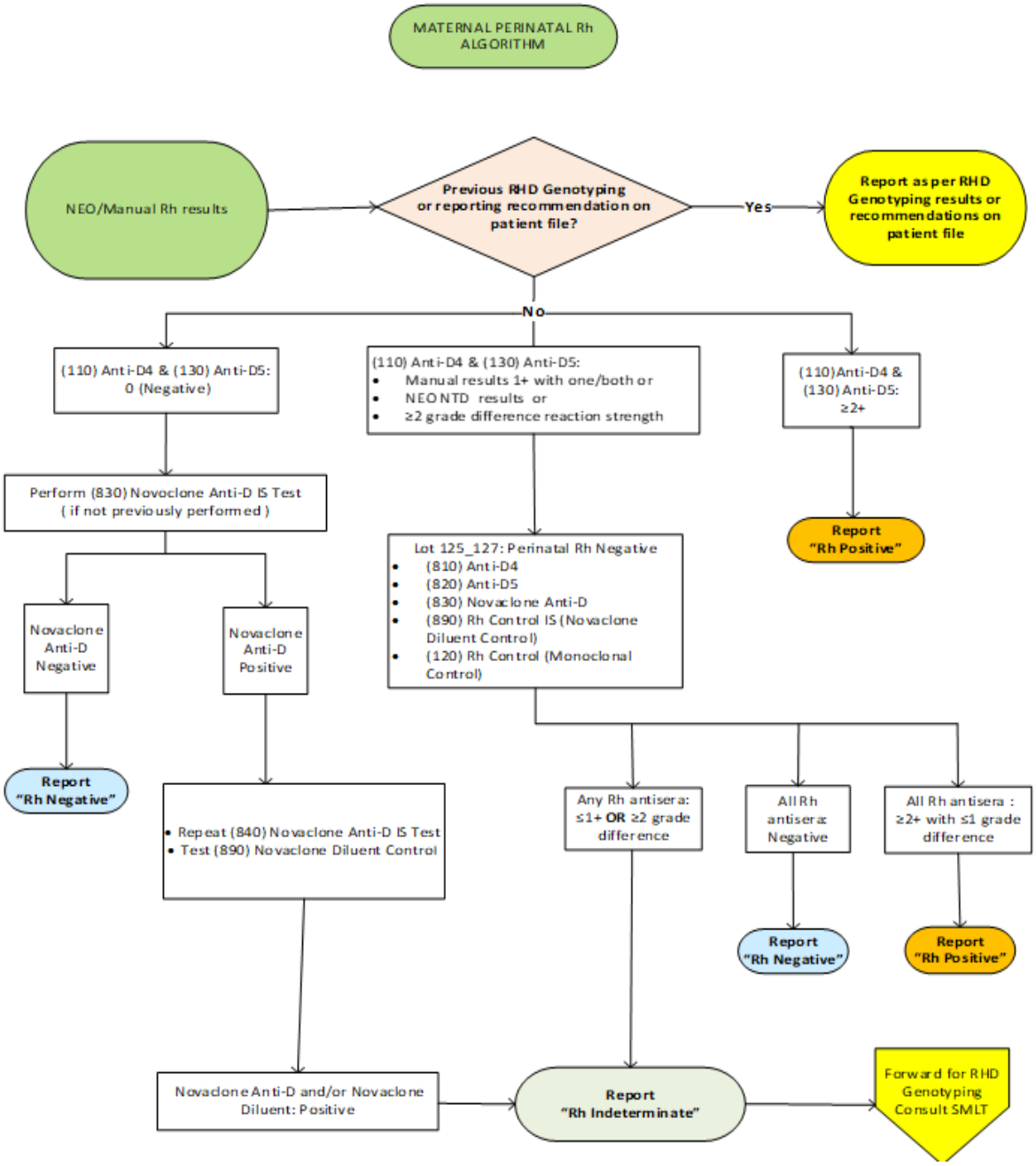
	HLA Antigen Typing	HLA Antibody Screen/Identification	HPA Antigen Typing	HPA Antibody Screen/Identification	Selection of HLA/HPA Selected Platelet Donors
Series1	1,116	108	261	321	307
Series2	1,392	144	302	432	369
Series3	1,205	141	316	437	395
Series4	1,200	167	292	390	333
Series5	1,198	117	286	446	289
Series6	1,170	129	297	489	486

RED CELL GENOTYPING

Canadian Blood Services is able to provide red cell antigen genotyping services through our National Immunohematology Reference Laboratory (NIRL) and Edmonton Diagnostic Services Laboratory. This service is used to aid in resolving complex immunohematology cases. Molecular testing combined with hemagglutination testing can provide better resolution to serological problems and guide patient transfusion requirements in some circumstances especially for sickle cell patients and patients with chronic transfusion requirements and multiple or complex antibodies.

Based on the following testing algorithm patients with serologically variable Rh D typing results may require genetic testing for the RHD gene.

Figure 9: Rh D Testing Algorithm



For 2020, the following results were obtained in patients using one of the two red cell antigen genotyping platforms available at CBS:

Table 8: Patient # - RHD Type/Result 2020

Patient	RHD Genotype	Predicted Phenotype	RHD Sequencing	Rh(D) Group
1	Weak D type 2	Weak D	RHD*01W.2	Positive
2	D Positive			Positive
3	Weak D type 4.0 or 4.3	Weak D	RHD*09.03 or RHD*09.05	Negative
4	Weak D type 1	Weak D	RHD*01W.1	Positive
5	Weak D type 2	Weak D	RHD*01W.2	Positive
6	Weak D type 1	Weak D	RHD*01W.1	Positive
7	Weak D type 2	Weak D	RHD*01W.2	Positive
8	Weak D type 1	Weak D	RHD*01W.1	Positive
9	D positive			Positive
10	Weak D type 2	Weak D	RHD*01W.2	Positive
11	DFR or DFR3		RHD*17.01 or RHD*17.03	Negative
12	D positive			Positive
13	D positive			Positive
14	Weak D type 3	Weak D	RHD*01W.3	Positive
15	Weak D type 1	Weak D	RHD*01W.1	Positive
16	D Positive			Positive
17	Weak D type 1	Weak D	RHD*01W.1	Positive
18	Weak D type 3	Weak D	RHD*01W.3	Positive
19	Weak D type 2	Weak D	RHD*01W.2	Positive
20	Weak D type 1	Weak D	RHD*01W.1	Positive
21	Weak D type 3	Weak D	RHD*01W.3	Positive
22	Weak D type 3	Weak D	RHD*01W.3	Positive
23	Weak D type 3	Weak D	RHD*01W.3	Positive
24	Weak D type 3	Weak D	RHD*01W.3	Positive
25	Weak D type 4 or 4.3	Weak D	RHD*09.03 or RHD*09.05	Negative
26	Norman RHD	D+	RHD*01	Positive

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 Winnipeg 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 9: Turnaround Time – Routine Criteria by Specimen Type

Specimen Type	Expected Turnaround Time	Expected % of Specimens Which Meet or Exceed Expected TAT
Routine Perinatal Specimens	72 hours	85%
Perinatal Specimens with Antibodies	72 hours	85%
Routine Crossmatch Specimens	24 hours	90%
Reference Specimens	72 hours	85%
Routine Platelet Immunology Specimens (NAIT, PTP, Platelet alloimmunization)	14 days	90%
HLA Disease Association Specimens	28 days	90%
HLA B*5701 Specimens	28 days	90%
Donor HLA/HPA Typing Specimens	60 days	90%

Table 10: Turnaround Time – Routine Perinatal Specimens

Turnaround Time (TAT)	2015	2016	2017	2018	2019	2020
% of Specimens Tested within 72 hours	93%	91%	94%	95%	92%	87%
% of Specimens Tested > 72 hours	11%	9%	9%	11%	8%	13%

Table 11: Turnaround Time – Routine Crossmatch Specimens

Turnaround Time (TAT)	2015	2016	2017	2018	2019	2020
% of Specimens Tested within 24 hours	99.80%	99.80%	99.80%	99.30%	99.30%	99.50%
% of Specimens Tested > 24 hours	0.20%	0.20%	0.20%	0.70%	0.70%	0.50%

Table 12: Turnaround Time – Reference Specimens

Turnaround Time (TAT)	2015	2016	2017	2018	2019	2020
% of Specimens Tested within 24 hours	99%	99%	99%	97%	97%	99%
% of Specimens Tested > 24 hours	1%	2%	1%	3%	3%	1%

Table 13: Turnaround Time - Platelet Immunology Specimens

Turnaround Time (TAT)	2015	2016	2017	2018	2019	2020
% of Specimens Tested within 14 days	94.50%	91.60%	85.3%*	97%	99%	98%
% of Specimens Tested within 28 days	96.80%	94.00%	95.30%	94%	98%	98%
% of Specimens Tested within 60 days	100%	95.00%	91%	99%	92%	100%

* Preliminary results reported within 1-2 days of sample receipt.

B. Rejected Specimens

Each time a specimen is rejected, a reason for rejection is entered into our laboratory information system (LIS). This data is then retrieved and analyzed on a quarterly basis.

As described in ***Table 14 and Figure 14*****,** the reasons for rejecting specimens in the Perinatal Laboratory are primarily problems with specimen labelling, requisitions and discrepancies between the requisition and the specimen. Average rejection rates have decreased from a high of 4.4% in 2012 to 3.6% in 2020 which correlates with increased efforts to contact customers and educate them on acceptable labelling criteria.

Table 15 and Figure 15 describe the reasons for rejecting specimens in the Crossmatch Laboratory; the majority of which involve problems with specimens. Problems with specimen labelling and discrepancies between the requisition and the specimen tube label constitute the main reasons for specimen rejection. Missing or incorrect information on the label and discrepancies in the name, personal health number (PHN) or date of collection continue to be the most common specimen labelling errors seen. Specimens are also rejected if the sample is a duplicate. The rejection rate for crossmatch specimens continued to remain low throughout 2020. The average rejection rates have decreased from a high of 2.9% in 2012 to 1.4% in 2020.

The rejection rates for perinatal specimens are higher than for crossmatch (pre-transfusion) specimens. The collection process for crossmatch specimens is controlled with stringent best practices and standards that must be followed. Crossmatch specimens are usually collected in hospitals and are sent to Canadian Blood Services via the hospital blood banks where the samples are pre-screened to determine if there are discrepancies between the sample and requisition. Perinatal specimens are most often collected in clinics and community collection sites where the identification and labelling process may be more variable. Although there may be differences in the collection process all specimens are scrutinized using the same stringent acceptance criteria prior to testing at Canadian Blood Services.

Some specimens for crossmatch have already been rejected by the referring hospital laboratory and total numbers of these rejected specimens are not included in our data.

Table 16 and Figure 16 describe the reasons for rejecting specimens in the Platelet Immunology Laboratory; the majority of which involve specimens. Samples may be rejected because of discrepancies between the specimen and the requisition, they are duplicate specimens that would not be tested; wrong tube type are all common reasons. The numbers represent an average rejection rate between both donor and patient rejections. Efforts to educate hospital customers continued throughout 2019 and 2020.

Table 14: Quarterly Rejection Rates – Perinatal Specimens 2020

Rejection Category	Q1	Q2	Q3	Q4
Requisition	87	42	71	50
Specimen	66	83	106	103
Discrepancies Between Requisition & Specimen	74	87	82	85
Discrepancies Between Current Requisition & Historical Records	17	15	28	27
Other	88	10	10	9
Total # specimens rejected	332	237	297	274
Total # specimens received	8,352	7,430	7,942	8,067
Rejections as a % of total	4.0%	3.2%	3.7%	3.4%

Figure 10: Perinatal Rejection Reasons

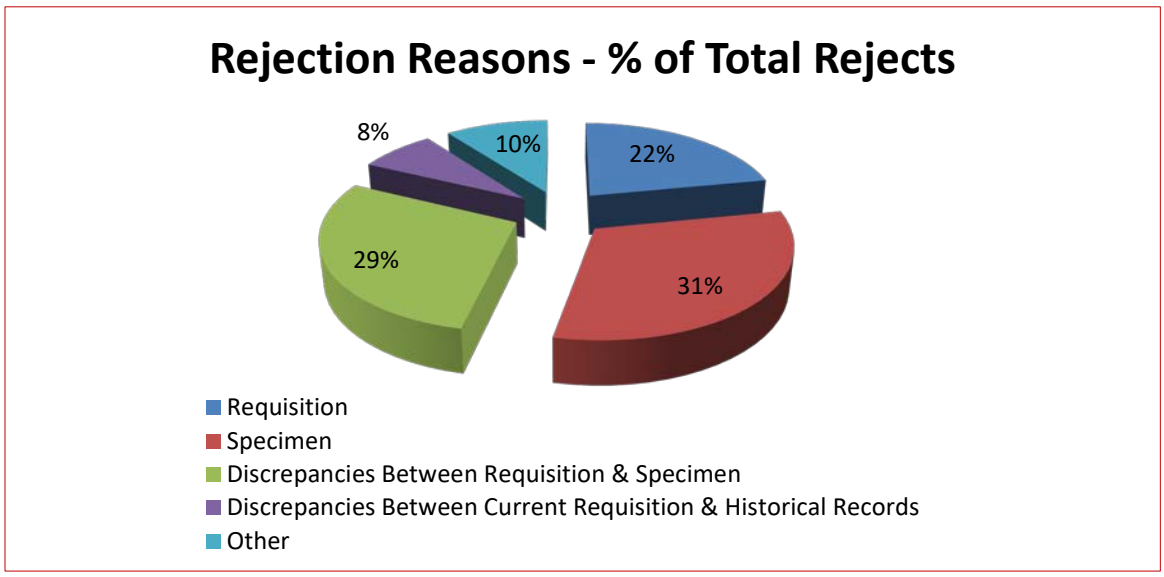


Table 15: Quarterly Rejection Rates – Crossmatch Specimens 2020

Rejection Category	Q1	Q2	Q3	Q4
Requisition	27	23	41	29
Specimen	45	57	67	94
Discrepancies Between Requisition & Specimen	70	74	71	101
Discrepancies Between Current Requisition & Historical Records	2	3	4	4
Other	36	8	11	7
Total # specimens rejected	180	165	194	235
Total # specimens received	14,185	11,588	14,824	13,647
Rejections as a % of total	1.3%	1.4%	1.3%	1.7%

Figure 11: Crossmatch Rejection Reasons 2020

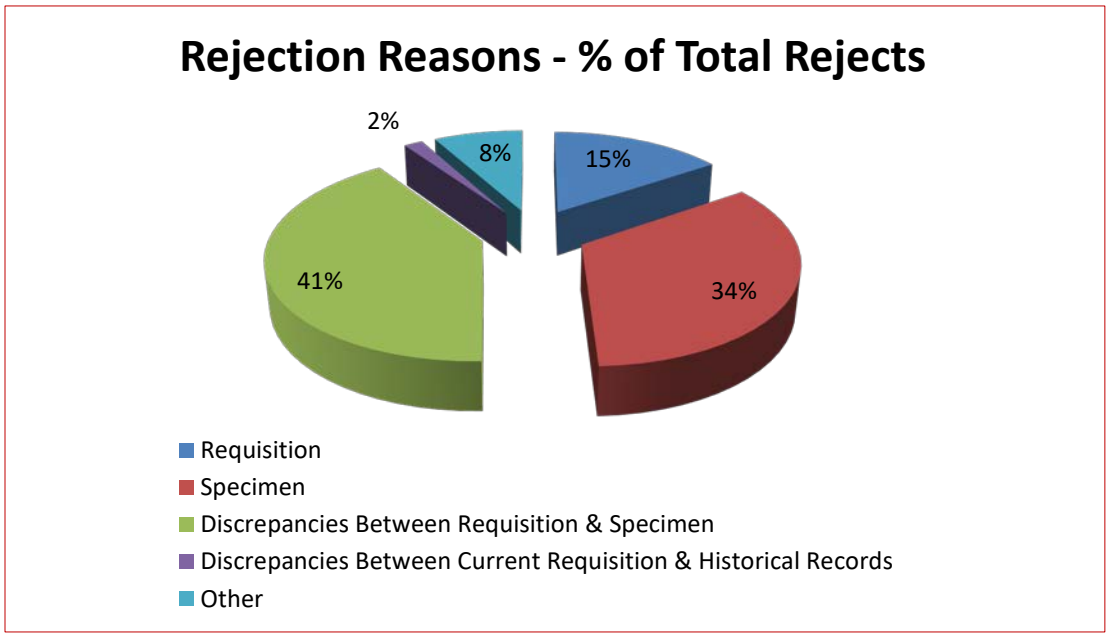
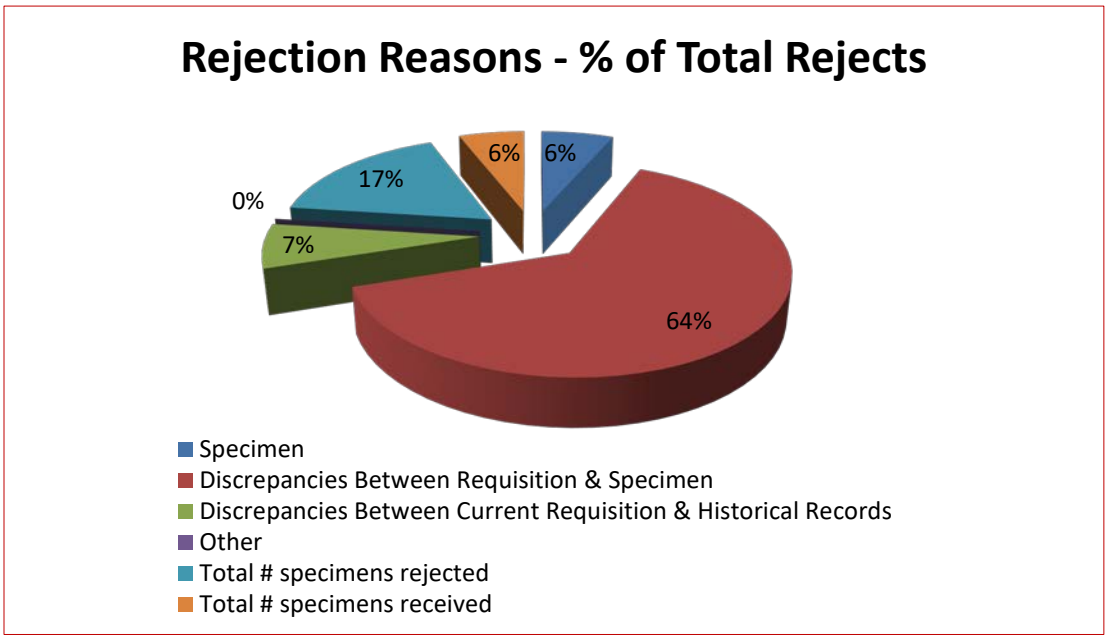


Table 16: Quarterly Rejection Rates – Platelet Immunology Specimens (Patient and Donor) 2020

Rejection Category	Q1	Q2	Q3	Q4
Requisition	3	2	3	3
Specimen	32	29	21	26
Discrepancies Between Requisition & Specimen	4	2	3	3
Discrepancies Between Current Requisition & Historical Records	0	0	0	0
Unable to Enter Results in PROGESA	4	10	5	10
Other	2	3	5	0
Total # specimens rejected	45	46	37	42
Total # specimens received	493	493	548	529
Rejections as a % of total	9.1%	9.3%	6.8%	7.9%

Figure 12: Platelet Immunology Rejection Reasons 2020



DIAGNOSTIC SERVICES UPDATE 2020

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

Vancouver	**Implementation of Electronically Fillable forms onto www.blood.ca** Perinatal Screen Request MM 1000107776 (2020-05-04) converted to electronic fillable form and posted on www.blood.ca. 2020-06-01 Diagnostic Services Antibody Investigation Request Form F801802 (2020-06-15)
Edmonton	**Implementation of the New CBS PN Requisition- 2020-01-07** A new CBS PN requisition was implemented in Edmonton on 2020-01-07 (F801780)
	Implementation of Electronically Fillable forms onto www.blood.ca Request for Perinatal Testing for Red Blood Cell Serology F801780 converted to electronic fillable form and posted on www.blood.ca. 2020-06-01. Request for RHD Genotyping (EN & FR) F801723, Request for Patient Blood Group Genotyping (EDM) F801221 and Request for Serological Investigation (EDM) F801897converted to electronic fillable form and posted on www.blood.ca. 2020-09-01
	CSPSA Accreditation Renewed- 2020

Winnipeg	**Preparation of Red Cell Aliquots for Neonatal and Pediatric Transfusion** The process to implement the preparation of small volume red cell aliquots- requested as either patient dose-specific (volume specific and irradiated) or as stock (standard size and non-irradiated) was implemented on 2020-01-27.
	Implementation of Electronically Fillable forms onto www.blood.ca Request for Perinatal Testing 1000107827 (Rh101) effective 2020-06-18 Request for Pre-Transfusion Testing 1000107837 (XM101A) effective 2021-01-11 Request for Blood Components 1000107830 (XM101) effective 2021-01-11 Request for Miscellaneous Testing 1000107834 (XM104) effective 2021-01-11 Transfusion Reaction Investigation 1000107838 (CM105) effective 2021-01-11 Platelet Immunology Laboratory Requisition 1000104677 effective 2021-01-11 TRALI Patient Data form 1000104723 effective 2021-01-11
	Discontinuation of 40 Week RhIG treatments Medical collaboration with Obstetrics department to review the value of RhIG treatment at 40 weeks in light of practice to treat at delivery resulted in a joint decision to discontinue the long-standing practice to treat at 40 weeks. Although the discussions and decisions were made in 2020, the change was effective 2021-01-15
	Incorporation of clinical interpretive comments on PI reports for FNAIT testing As a customer satisfaction initiative, standardized comments were developed that would be included for the common results' scenarios found when Maternal, Paternal, and sometimes Neonatal samples are submitted for Fetal/Neonatal Allo-Immunization Testing (FNAIT). Implemented on 2020-07-27.

Presentations / Abstracts / Publications Listing
M Farrell,[1] G Clarke,[1,2] G Barr, [2] J Hannon[1,2] **Monitoring of Prenatal Patients Using a Combined Antibody Titre for Rh and non-Rh Antibodies** Transfusion Medicine, Volume 30 Issue 3 January 19, 2020
Antoine Lewin, Shadhiya al Khan, Lynnette Beaudin, Lynne Meilleur, Gwen Clarke, Lucie Richard. **Report on the 19th International Society of Blood Transfusion Platelet Immunology Workshop 2018** Vox Sanguinis/ Volume 115, Issue 8/ p. 767-782, 28 May 2020
Lhevinne Ciurcovich/Heba Abukhadra **Back to Typing School – A Primer on Resolving Blood Grouping Anomalies",** Presentation for CBS/ PBCO Education Day, 01 Oct 2020