Canadian Blood Services

BLOOD
PLASMA
STEM CELLS
ORGANS
& TISSUES

DIAGNOSTIC SERVICES

MANITOBA

YEAR IN REVIEW

JANUARY – DECEMBER 2018

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 Titre, 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 three 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 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.

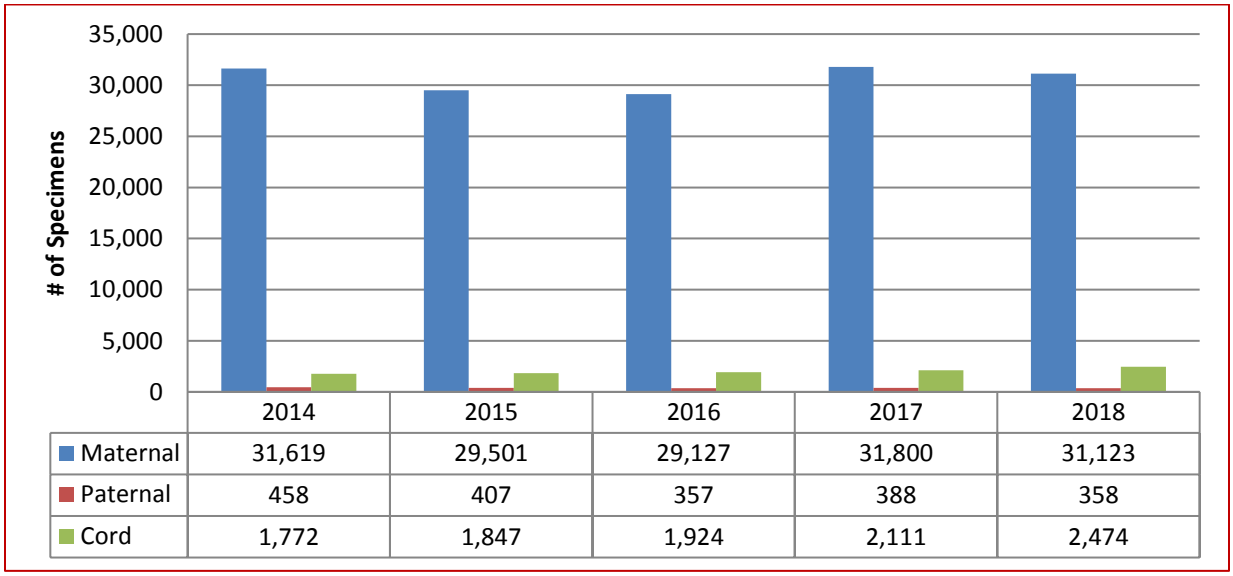
C. Specimens Tested

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	2014	2015	2016	2017	2018
Maternal	Type and Screen	31,619	29,501	29,127	31,800	31,123
Paternal	ABO/Rh	458	407	357	388	358
Cord	ABO/Rh	1,772	1,847	1,924	2,111	2,474
Total # of Specimens Tested		33,849	31,755	31,408	34,299	33,955
Total # of Patients Tested		**24,179**	**24,005**	**23,980**	**24,248**	**24,079**

Figure 1: Total Perinatal Specimens Tested



D. Antibodies Identified

In 2018, a total of 246 antibodies were reported (see *Table 2*). This is slightly lower than 2017 where 259 antibodies were reported. Two hundred and sixteen women had antibodies identified during their pregnancies (decreased from 237 women in 2017), of these; 198 women had clinically significant antibodies and 18 had clinically insignificant antibodies. Thirty-two women had multiple clinically significant 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-E, anti-K, anti-Jk^{a}, anti-M (IgG), anti-c, and anti-D (see *Figure 3*) which together represented 79.8% of the total antibodies identified.

Titres for 5 of the clinically significant antibodies increased from non-critical to critical levels during the pregnancy with a total of 22 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 Clinically Significant Antibodies Detected - 2018					
Antibody	**2014**	**2015**	**2016**	**2017**	**2018**
Anti-D	21	10	12	11	11
Anti-C	19	18	10	9	10
Anti-C^{w}	1	1	2	2	0
Anti-Ce	1	0	0	0	0
Anti-ce	0	0	0	0	1
Anti-c	18	17	17	20	12
Anti-E	70	65	63	66	64
Anti-e	9	6	5	8	6
Anti-f	1	1	0	0	1
Anti-G	0	5	2	1	2
Anti-Ge3	0	0	0	0	1
Anti-K	64	57	47	56	58
Anti-Kp^{a}	1	1	1	1	0
Anti-Kp^{b}	0	0	1	1	0
Anti Lu^{a}	0	0	1	1	0
Anti-Lu^{b}	3	1	2	0	0
Anti-M*	11	12	9	18	16
Anti-S	6	7	6	6	7
Anti-s	1	1	1	2	0
Anti-Fy^{a}	3	5	4	4	4
Anti-Fy^{b}	2	2	1	4	4
Anti-Jk^{a}	20	20	17	20	17
Anti-Jk^{b}	8	1	5	4	4
Anti-Jk^{3}	0	0	0	1	0
Anti-Di^{a}	2	1	0	0	1
Anti-Di^{b}	0	0	0	0	1
Anti Mi^{a}	0	0	0	0	1
Anti-V	0	0	1	1	1
Anti-Wr^{a}	2	2	2	2	1
TOTAL	**263**	**233**	**209**	**238**	**223**

*Anti-M – IgG antibody detected

Maternal Clinically Insignificant Antibodies Detected - 2018					
Antibody	**2014**	**2015**	**2016**	**2017**	**2018**
Anti-A_1	0	0	0	1	0
Anti-He	0	0	0	1	0
Anti-JMH	0	0	0	1	1
Anti-Le^a	23	12	13	11	17
Anti-Le^b	3	1	2	2	2
Anti-N	0	0	0	2	1
Anti-P_1	4	0	0	3	2
Passive Anti-D (not included in totals)	1059	892	738	813	763
TOTAL	**30**	**13**	**15**	**21**	**23**

Table 3: Perinatal Patient Antibody Titres

Antibody	Critical Level	Non-Critical Level	Non-Critical to Critical
Anti-D	4	5	1
Anti-C	0	5	0
Anti-E	5	41	2
Anti-c	1	5	0
Anti-e	1	2	0
Anti-DC	1	1	0
Anti-DE	1	0	0
Anti-Ec	1	4	1
Anti-Ce	0	2	0
Anti-G	0	0	0
Anti-DG	0	0	0
Anti-CG	0	1	0
Anti-K*	7	0	0
Anti-Fya	0	3	0
Anti-Fyb	0	2	0
Anti-Jka	0	4	0
Anti-Jkb	1	3	1
Anti-M	0	11	0
Anti-S	0	3	0
Anti-s	0	0	0
TOTAL	**22**	**92**	**5**

***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.

Figure 2: Total Number of Perinatal Antibodies

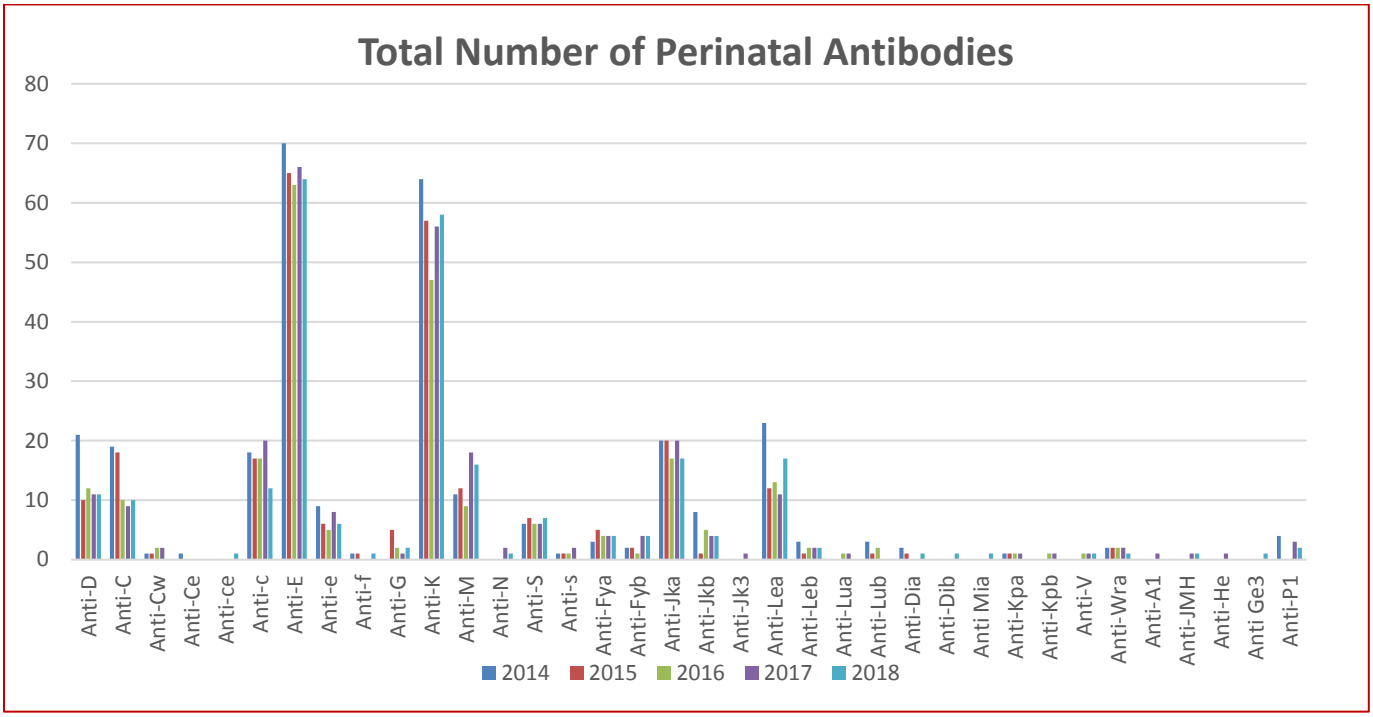


Figure 3: Frequency of Clinically Significant Antibodies

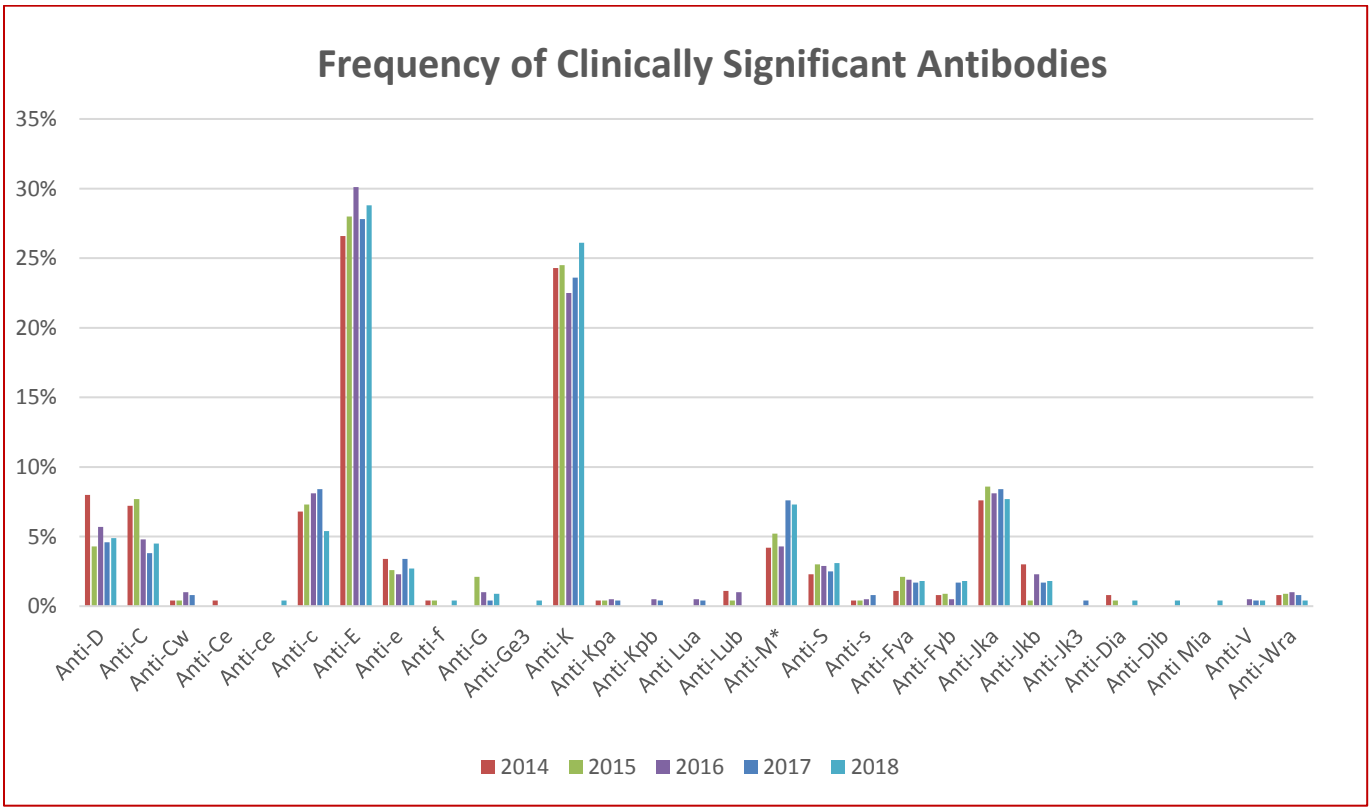


Table 4: Combination Antibodies

Antibodies	Number in 2018
Anti-C, Anti-D	1
Anti-C, Anti-D, Anti-G	1
Anti-C, Anti-D, Anti-Jka, Anti-S	1
Anti-c, Anti-Dia	1
Anti-c, Anti-E	3
Anti-C, Anti-e	1
Anti-c, Anti-E, Anti-Fya, Anti-K, Anti-Lea	1
Anti-c, Anti-E, Anti-Jka	1
Anti-c, Anti-E, Anti-S	1
Anti-C, Anti-G	1
Anti-C, Anti-Jkb	1
Anti-c, Anti-K	2
Anti-C, Anti-M	1
Anti-D, Anti-E	1
Anti-D, Anti-Fya	1
Anti-D, Anti-G	1
Anti-e, Anti-f	1
Anti-E, Anti-Fya	1
Anti-e, Anti-Jka	1
Anti-E, Anti-K	3
Anti-E, Anti-Lea	1
Anti-Fyb, Anti-K	2
Anti-Lea, Anti-Leb	1
Anti-Lea, Anti-Mia	1
Total	**30**

CROSSMATCH / REFERENCE LABORATORY

The Crossmatch / Reference Laboratory within Diagnostic Services provides centralized transfusion medicine services and testing to 70 hospitals in Manitoba and eastern Nunavut that do not perform these tests. Reference services are provided for 5 rural hospitals with crossmatching laboratories in Manitoba and 12 hospitals in Northwest Ontario.

Manitoba Diagnostic Services contributes to continuing technologist education at provincial or national transfusion medicine conferences. (Refer to Accomplishments – page 29).

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
- Donath-Landsteiner Test

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.
As a Reference Laboratory, 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.

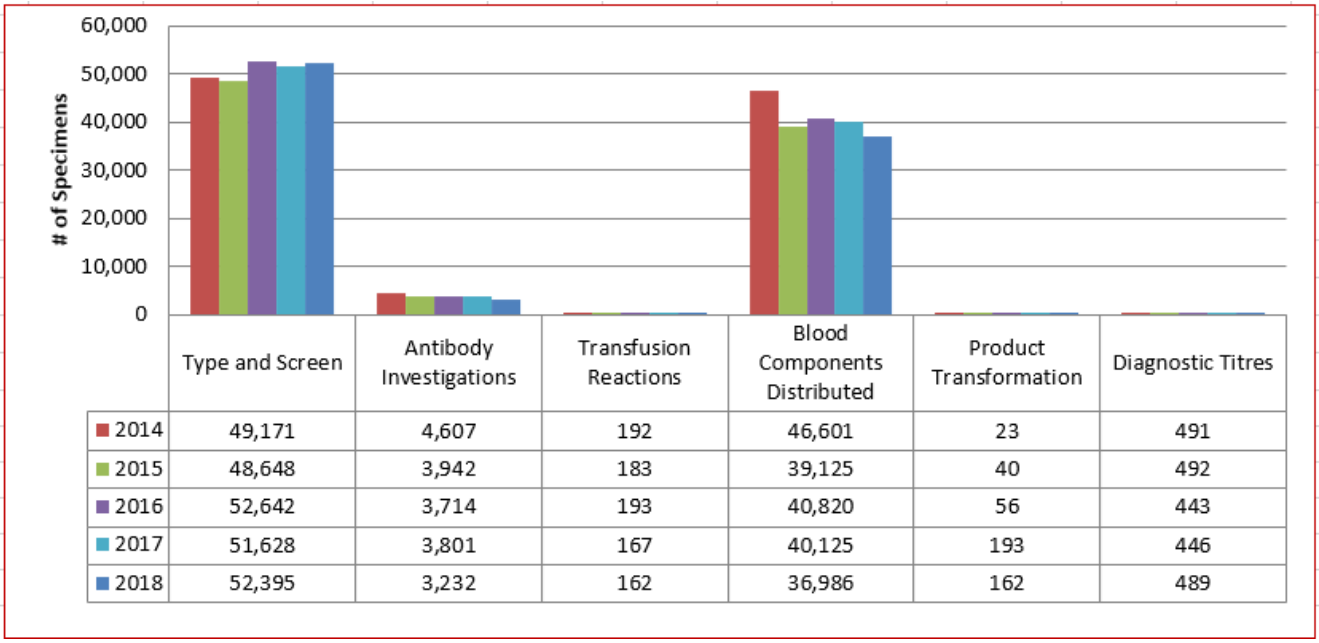
The total number of crossmatch specimens tested has remained fairly consistent over the last 4 years as illustrated in *Table 5* below. The implementation of the Trace Line laboratory information system (LIS) was completed at 16 hospitals in Winnipeg and rural Manitoba in 2015. These hospitals now hold 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 slight reduction in red blood cell utilization. Product transformations remained high in 2018. This was primarily due to one patient who required chronic platelet transfusions with plasma reduced platelets as a result of mild allergic, anaphylactic transfusion reaction.

Table 5: Crossmatch/Reference Specimens Tested

Specimen Type	Test Type	2014	2015	2016	2017	2018
Crossmatch/Reference	Type and Screen	49,171	48,648	52,642	51,628	52,395
	Antibody Investigations	4,607	3,942	3,714	3,801	3,232
	Transfusion Reaction Investigations	192	183	193	167	162
	Blood Components Distributed	46,601	39,125	40,820	40,125	36,986
	Product Transformation	23	40	56	193	162
	Diagnostic Titres (Cold agglutinin, Isohemagglutinins)	491	492	443	446	489
Test Totals (excluding components distributed)		54,484	53,305	57,048	56,235	55,341
Number of Patients Tested		**29,751**	**29,219**	**31,200**	**30,553**	**31,025**

Figure 4: Total Crossmatch Specimens Tested



C. Antibodies Identified

In 2018, a total of 349 antibodies were reported (see *Table 6*). The total number of antibodies detected is slightly decreased from 2017 where 364 antibodies were reported, but the distribution of the most common antibodies remains consistent. Two hundred and ninety-five patients had antibodies identified, of these; 47 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-E, anti-K, anti-D, anti-C, anti-Jk[a], and anti-Fy[a] (see *Figure 5*) which together represented 80.5% of the total antibodies identified.

Figure 5: Total Number of Crossmatch Antibodies

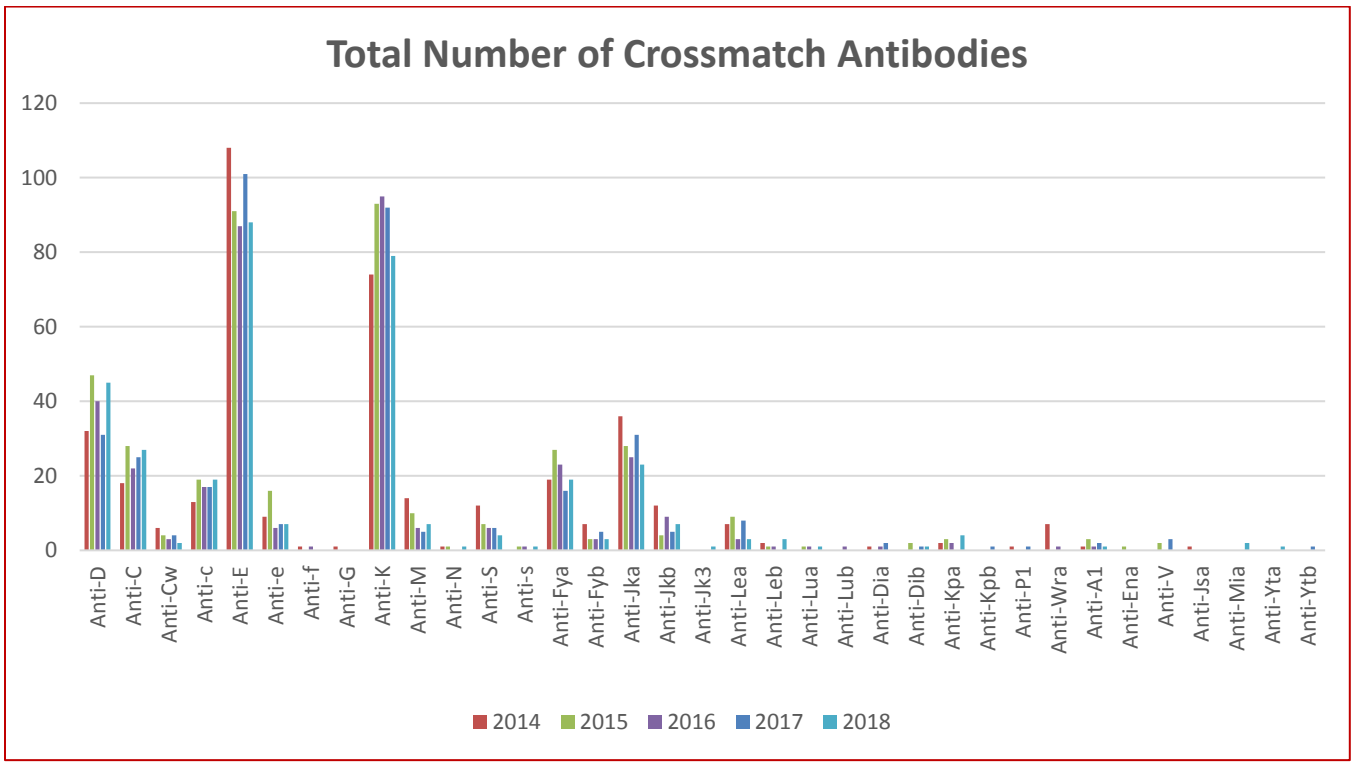


Table 6: Total Number of Crossmatch Antibodies Detected

Antibody	2014	2015	2016	2017	2018
Anti-D	32	47	40	31	45
Anti-C	18	28	22	25	27
Anti-C^w	6	4	3	4	2
Anti-c	13	19	17	17	19
Anti-E	108	91	87	101	88
Anti-e	9	16	6	7	7
Anti-f	1	0	1	0	0
Anti-G	1	0	0	0	0
Anti-K	74	93	95	92	79
Anti-M	14	10	6	5	7
Anti-N	1	1	0	0	1
Anti-S	12	7	6	6	4
Anti-s	0	1	1	0	1
Anti-Fy^a	19	27	23	16	19
Anti-Fy^b	7	3	3	5	3
Anti-Jk^a	36	28	25	31	23
Anti-Jk^b	12	4	9	5	7
Anti-Jk^3	0	0	0	0	1
Anti-Le^a	7	9	3	8	3
Anti-Le^b	2	1	1	0	3
Anti-Lu^a	0	1	1	0	1
Anti-Lu^b	0	0	1	0	0
Anti-Di^a	1	0	1	2	0
Anti-Di^b	0	2	0	1	1
Anti-Kp^a	2	3	2	0	4
Anti-Kp^b	0	0	0	1	0
Anti-P_1	1	0	0	1	0
Anti-Wr^a	7	0	1	0	0
Anti-A_1	1	3	1	2	1
Anti-En^a	0	1	0	0	0
Anti-V	0	2	0	3	0
Anti-Jsa	1	0	0	0	0
Anti-Mia	0	0	0	0	2
Anti-Yta	0	0	0	0	1
Anti-Ytb	0	0	0	1	2
Total	**385**	**401**	**355**	**364**	**349**

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 be affected by platelet function disorders (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.

Maintaining enough apheresis platelet donors tested for HLA/HPA has always been a high priority for Canadian Blood Services. This goal allows for a greater pool of available antigen typed donors used in the selection of HLA/HPA compatible platelets for high risk patients. In 2018 there was a significant increase in the number of donors typed for HLA and HPA. The additional HLA typings were due to re-typing donors by molecular methods in order to bring them back into the HLA/HPA program and be available for specialized products. The additional HPA typings were due to a new process able to target HPA-1b/1b donors requiring confirmatory testing.

Table 7: Platelet Immunology Specimens Tested

Specimen Type	Test Type	2014	2015	2016	2017	2018
Donor	HLA Antigen Typing	976	1,560	1,087	1,171	3,728
	HLA Antibody Screen/Identification	30	58	41	29	17
	HPA Antigen Typing	579	804	528	648	1,918
	HPA Antibody Screen/Identification	13	19	10	79	9
Patient	HLA Antigen Typing	1,143	1,116	1,392	1,205	1,200
	HLA Antibody Screen/Identification	99	108	144	141	167
	HPA Antigen Typing	120	261	302	316	292
	HPA Antibody Screen/Identification	200	321	432	437	390
	Selection of HLA/HPA Matched Platelet Donors	369	307	369	395	333
Test Totals		**3,529**	**4,354**	**4,305**	**4,510**	**8,054**

Figure 6: Total Platelet Immunology Donor Specimens Tested

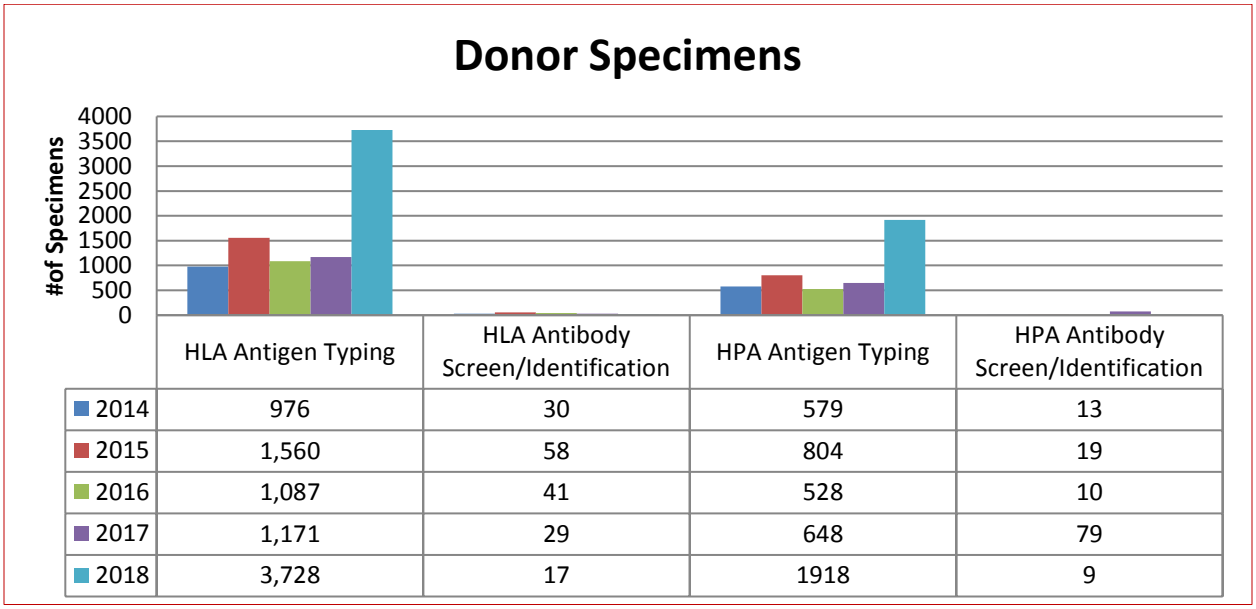
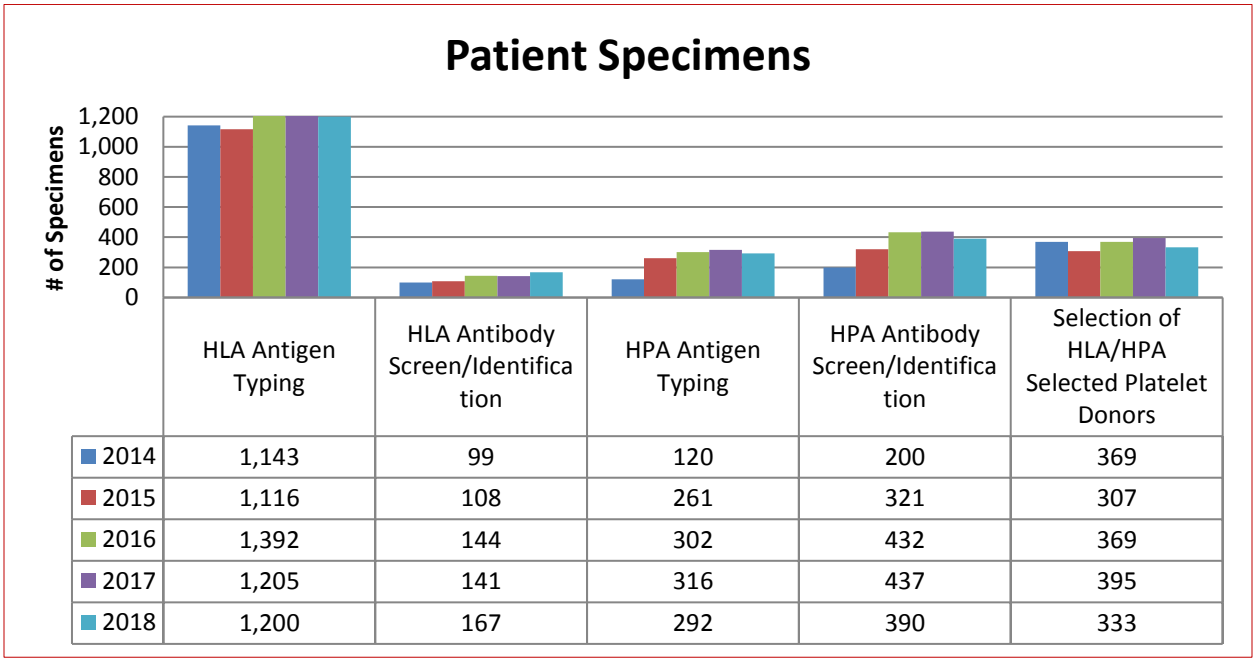


Figure 7: Total Platelet Immunology Patient Specimens Tested



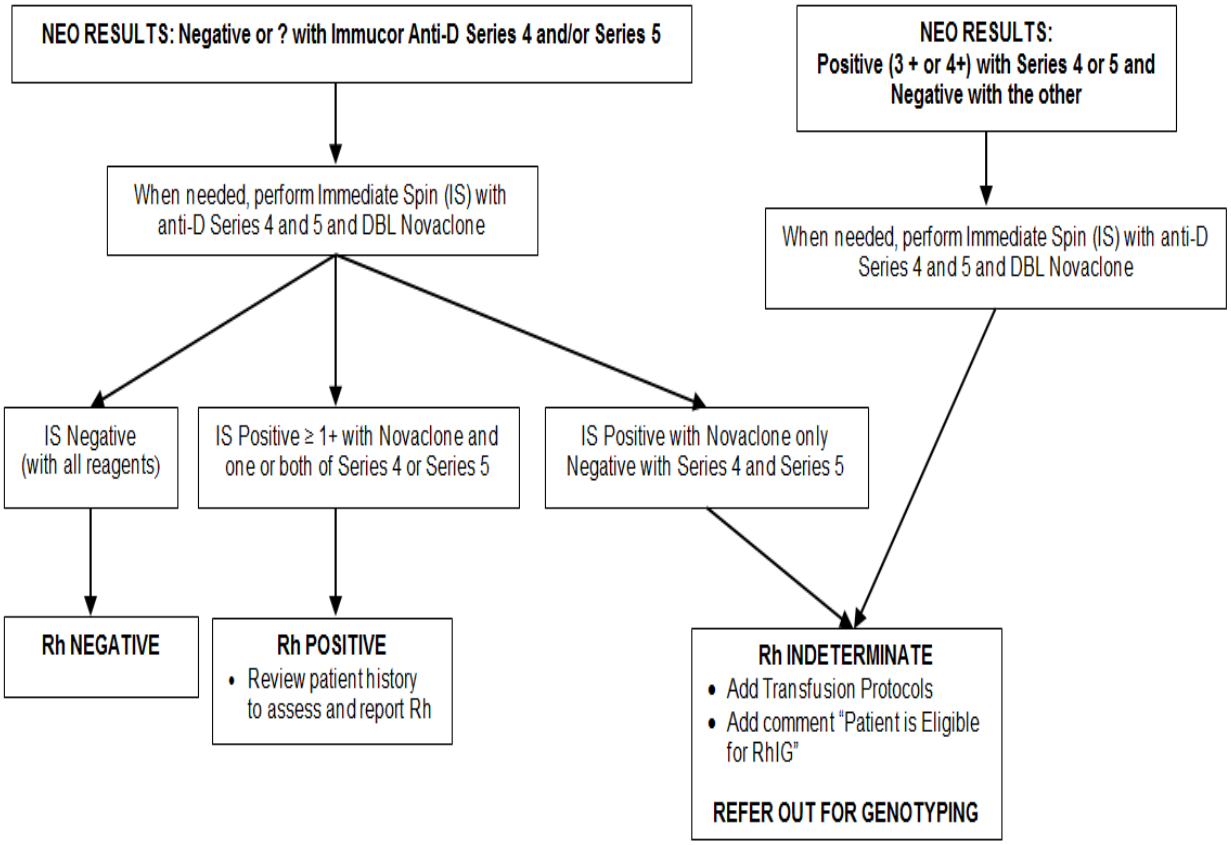
	HLA Antigen Typing	HLA Antibody Screen/Identification	HPA Antigen Typing	HPA Antibody Screen/Identification	Selection of HLA/HPA Selected Platelet Donors
2014	1,143	99	120	200	369
2015	1,116	108	261	321	307
2016	1,392	144	302	432	369
2017	1,205	141	316	437	395
2018	1,200	167	292	390	333

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. A process for the referral of perinatal specimens to Edmonton and pre-transfusion specimens to NIRL for genotyping was developed and implemented. 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, in particular for sickle cell patients and patients with frequent transfusion requirements.

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

Figure 8: Rh D Testing Algorithm



For 2018, 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

Patient	RHD Genotype	Predicted Phenotype	RHD Sequencing	Rh Group
1	Weak D type 1	Weak D	Not performed	Positive
2	Weak D type 2	Weak D	Not performed	Positive
3	Weak D type 1	Weak D	Not performed	Positive
4	Weak D type 1	Weak D	Not performed	Positive
5	Weak D type 1	Weak D	Not performed	Positive
6	Weak D type 2	Weak D	Not performed	Positive
7	DAR	Partial D	Not performed	Negative
8	Weak D type 1	Weak D	Not performed	Positive
9	Weak D type 2	Weak D	Not performed	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)	2014	2015	2016	2017	2018
% of Specimens Tested within 72 hours	89.3%	92.3%	91%	94%	94.8%
% of Specimens Tested > 72 hours	10.7%	7.7%	9%	6%	5.2%

Figure 9: Perinatal Routine TAT

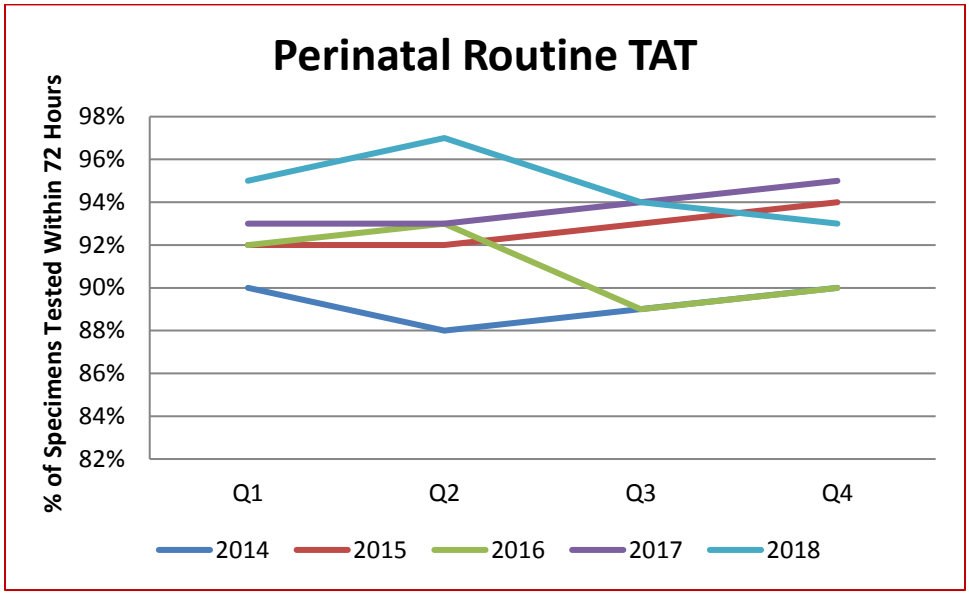


Table 11: Turnaround Time – Routine Crossmatch Specimens

Turnaround Time (TAT)	2014	2015	2016	2017	2018
% of Specimens Tested within 24 hours	99.6%	99.8%	99.8%	99.8%	99.3%
% of Specimens Tested > 24 hours	0.4%	0.2%	0.2%	0.2%	0.7%

Figure 10: Crossmatch Routine TAT

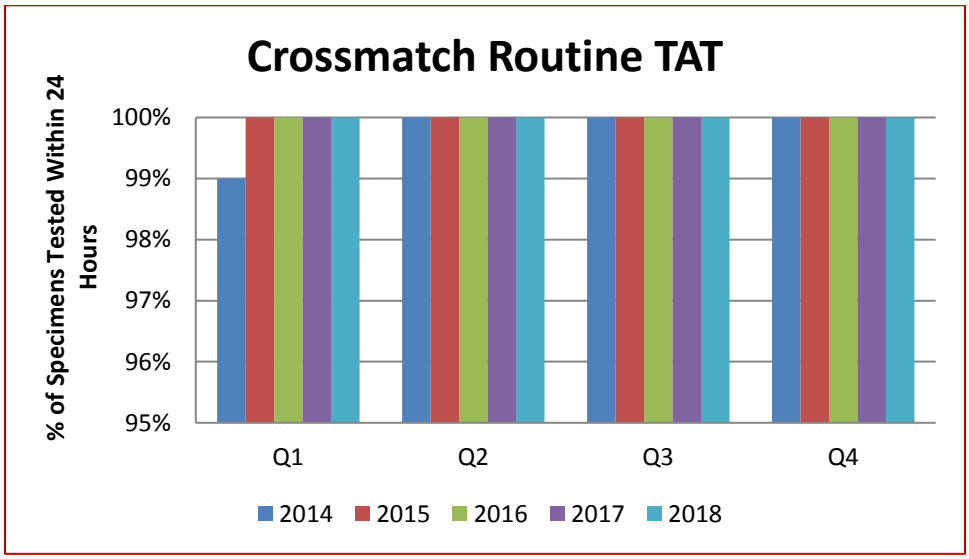


Table 12: Turnaround Time – Reference Specimens

Turnaround Time (TAT)	2014	2015	2016	2017	2018
% of Specimens Tested within 24 hours	96.8%	98.8%	98.5%	99%	97.4%
% of Specimens Tested > 24 hours	3.2%	1.2%	1.5%	1%	2.6%

Figure 11: Reference TAT

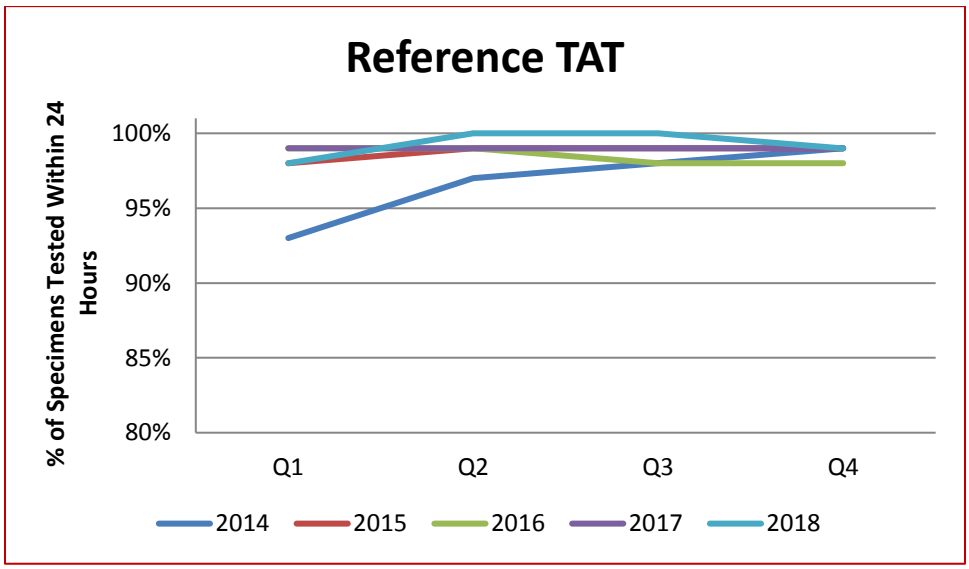
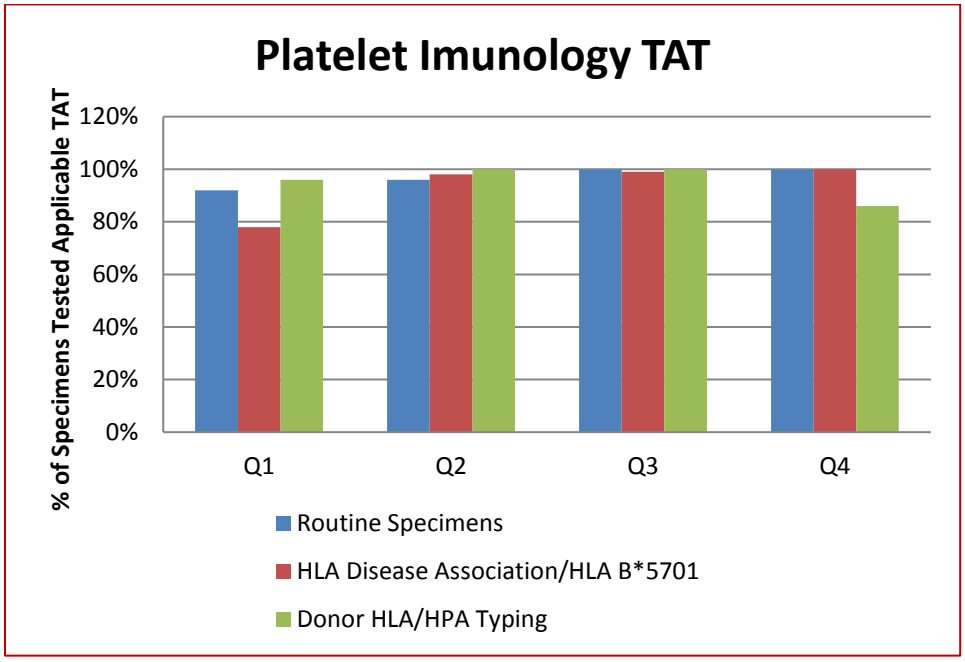


Table 13: Turnaround Time - Platelet Immunology Specimens

Turnaround Time (TAT)	2014	2015	2016	2017	2018
% of Specimens Tested within 14 days	91.8%	94.5%	91.6%	85.3%*	97%
% of Specimens Tested within 28 days	98.9%	96.8%	94.0%	95.3%	94%
% of Specimens Tested within 60 days	100%	100%	95.0%	91%	99%

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

Figure 12: Platelet Immunology TAT



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 13*, the reasons for rejecting specimens in the Perinatal Laboratory are primarily problems with requisitions, specimen labelling and discrepancies between the requisition and the specimen. Average rejection rates have decreased from a high of 4.4% in 2012 to 3.4% in 2018 which correlates with increased efforts to contact customers and educate them on acceptable labelling criteria.

Table 15 and Figure 14 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 2018. The average rejection rates have decreased from a high of 2.9% in 2012 to 1.4% in 2017.

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.

As previously mentioned, many 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 15 describe the reasons for rejecting specimens in the Platelet Immunology Laboratory; the majority of which involve specimens. Ninety-six percent of the specimens in this category were rejected because they were duplicate specimens that would not be tested; wrong tube type was the next most common reason. Efforts to educate hospital customers continued throughout 2018. Average rejection rates have decreased from 9.6% in 2016 to 6.3% in 2018.

Table 14: Quarterly Rejection Rates – Perinatal Specimens

Rejection Category	Q1	Q2	Q3	Q4
Requisition	123	89	83	118
Specimen	91	139	117	93
Discrepancies Between Requisition & Specimen	59	37	82	57
Discrepancies Between Current Requisition & Historical Records	22	13	8	10
Other (Duplicates, etc.)	4	8	23	14
Total # specimens rejected	299	286	313	292
Total # specimens received	8,762	8,992	8,636	8,799
Rejections as a % of total	**3.4%**	**3.2%**	**3.6%**	**3.3%**

Figure 13: Perinatal Rejection Reasons

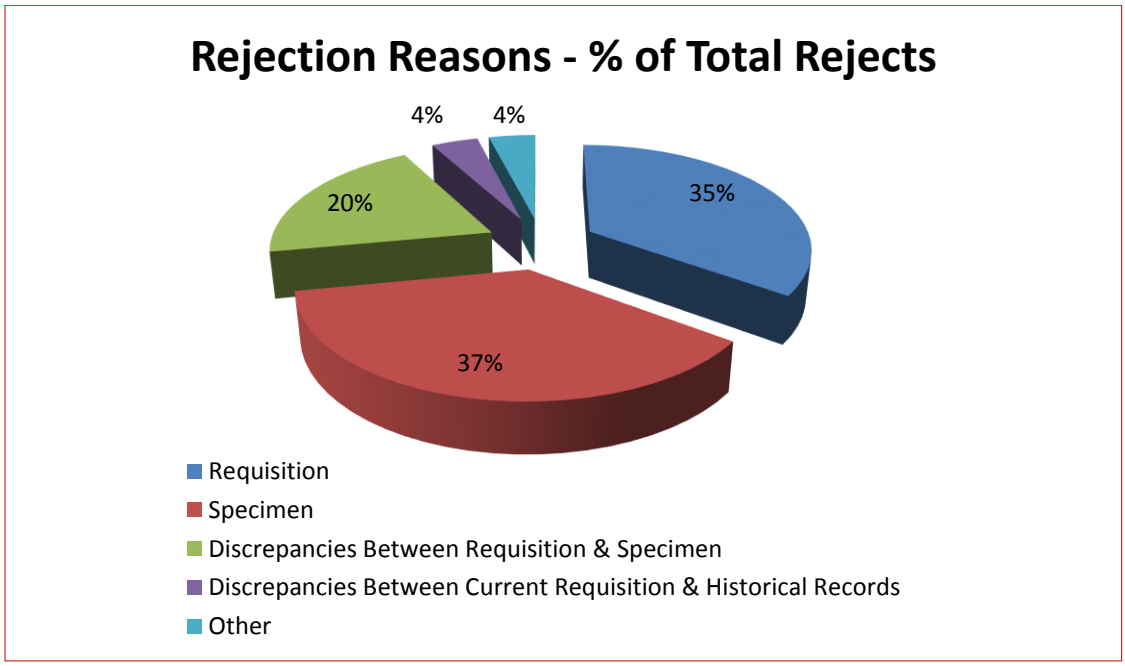


Table 15: Quarterly Rejection Rates – Crossmatch Specimens

Rejection Category	Q1	Q2	Q3	Q4
Requisition	26	36	29	24
Specimen	94	66	73	85
Discrepancies Between Requisition & Specimen	85	68	81	64
Discrepancies Between Current Requisition & Historical Records	2	2	1	2
Other (Duplicates, etc.)	23	10	9	6
Total # specimens rejected	230	182	193	181
Total # specimens received	13,959	14,469	13,526	14,725
Rejections as a % of total	**1.6%**	**1.3%**	**1.4%**	**1.2%**

Figure 14: Crossmatch Rejection Reasons

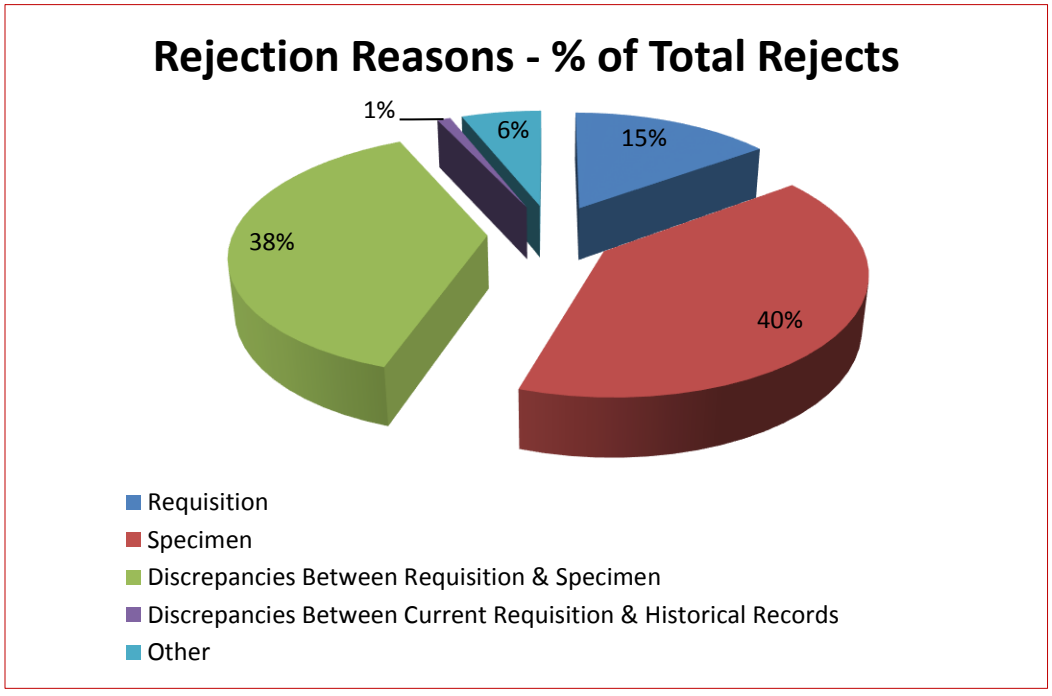
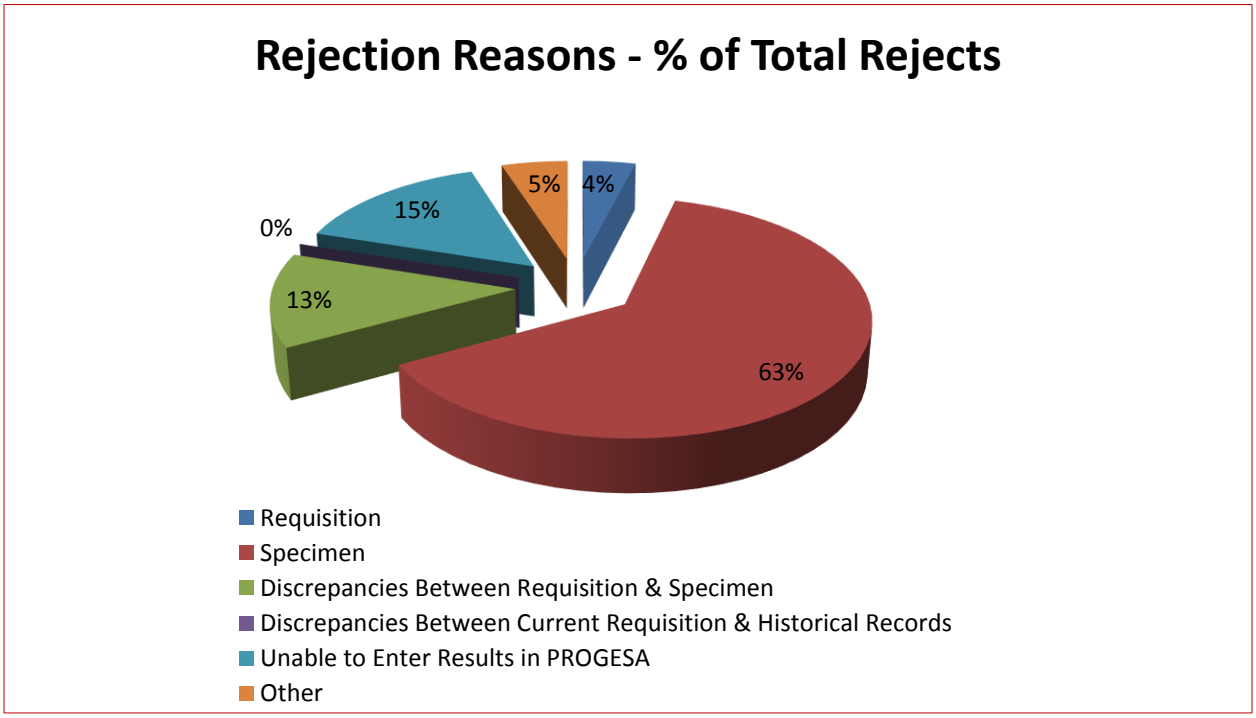


Table 16: Quarterly Rejection Rates – Platelet Immunology Specimens

Rejection Category	Q1	Q2	Q3	Q4
Requisition	4	0	3	1
Specimen	24	53	38	25
Discrepancies Between Requisition & Specimen	8	10	6	5
Discrepancies Between Current Requisition & Historical Records	0	0	0	0
Unable to Enter Results in PROGESA	7	11	6	10
Other (Duplicates, etc.)	7	3	1	0
Total # specimens rejected	50	77	54	41
Total # specimens received	584	1,290	1,108	709
Rejections as a % of total	**8.6%**	**5.9%**	**4.9%**	**5.8%**

Figure 15: Platelet Immunology Rejection Reasons



ACCOMPLISHMENTS IN 2018

A. BEST Collaborative TUBE Study Part 2 (Testing the Utility of Collecting Blood Samples Electronically)

The laboratory participated in the BEST Collaborative TUBE Study Part 2 which was designed to determine the rate of Wrong Blood in Tube (WBIT) errors in mislabeled samples that would normally be rejected. An ABO and RhD type was performed on these mislabeled samples and compared to the historical ABO and RhD type on file in the laboratory. Data was collected until 200 mislabeled samples had been received.

B. Cell Free Fetal DNA Testing (cff DNA)

Cell free fetal DNA testing is available by referral to the National Health Services (NHS) Laboratories in Bristol, UK. This testing will be performed on selected patients, referred by maternal fetal medicine physicians based on clinically significant red cell allo antibodies known to cause hemolytic disease of the fetus and newborn. Results of this DNA testing will help to determine which patients require follow up in a high risk obstetrical clinic and which can return to a routine prenatal care setting. The Manitoba government has agreed to fund cff DNA test requests on a case by case basis.

C. College of American Pathologists (CAP) Laboratory Accreditation

An on-site inspection of the Red Cell Serology Laboratories occurred on June 27, 2018 and met the requirements of the LAP Standards for Accreditation. Accreditation is granted for the 2 year period ending in July 2020.

D. Diagnostic Services Web Page Redesign

All Diagnostic Services sites (Vancouver, Edmonton, Regina, Winnipeg, Brampton) and National Immunohematology Reference Laboratory (NIRL) collaborated in a project to redesign and refresh the current Diagnostic Services webpages on www.blood.ca. The new laboratory services site includes test catalogues, quick links and a redesigned page layout which is more user friendly. Please visit the new web site (https://blood.ca/en/hospital-services) which launched on June 25, 2018.

E. Health Canada Licensure of Platelet Immunology Laboratory

The Platelet Immunology Laboratory provides HLA/HPA antigen testing and HPA antibody screening for new apheresis platelet donors. CBS' license with Health Canada did not extend to donor HLA or HPA testing for the selection of matched platelets. A submission to Health Canada was made in July 2018 and the inclusion to the CBS license was granted in November 2018.

F. LEAN Continuous Improvement Review of Red Cell Serology Laboratories

A LEAN continuous improvement review of the Red Cell Serology Laboratories (Perinatal and Crossmatch Labs) was conducted in late 2016. In late 2017 a project team was assembled to assess and implement the recommendations made in the review. Improvements included redesign of the workflow and layout of the Red Cell Serology Laboratories and cross-training all staff to both perinatal and pre-transfusion testing. The goal was to improve quality, eliminate waste/re-work, reduce movement and wait time and more efficiently use people's talents. The renovations and other improvements were completed in November 2018. Cross-training of staff was begun and will continue into 2019.

G. National Advisory Committee (NAC) Recommendations for Use of Irradiated Blood Components

The NAC recommendations for the use of irradiated blood components were released in May 2018. A review of these recommendations took place to assess the impact on current operations and some changes to the laboratory information system were identified to aid with the implementation of the guidelines.

H. Perinatal Advisory Council

The PNAC continues to collaborate throughout the year and at an annual November meeting. In 2018 several initiatives were finalized including a strategy for automated testing of passive anti-D on the NEO analyzer, a standardized and updated investigation algorithm for patients with weak serological reactivity with anti-D reagents and a standardized algorithm and repeat testing strategy for prenatal patients with anti M. These initiatives will be implemented in early 2019 with the final versions of a new Work Instruction format at all CBS perinatal testing labs.

The group reviewed and discussed recent national and international guidelines concerning recommendations for testing all prenatal patients with a repeat antibody investigation in mid pregnancy. Cost estimates were presented along with the calculated rate of new antibodies in this prenatal population. The group agreed to additional studies and collaboration with hospitals related to risks of antibody development in this group – possibly with feedback to the SOGC group based on the results.

Additional research and collaboration regarding a change in titration strategy to include titration of multiple antibodies as combined titers was also planned – with prospective studies to proceed in the future.

PNAC had a wide-ranging discussion related to the investigation strategies for referral samples.

Ongoing work over the coming year will include concentrated efforts to update and standardize work instructions and to continue with plans for integrating NIRL donor and patient testing into the Brampton antibody investigation laboratory.

I. Presentations / Abstracts / Publications

- Barr, L. Ciurcovich, T. Dolnik, R. Fallis, L. Grabner, J. Hannon, T. Ison. ***Anti-G Testing and Titration Strategy in Prenatal Patients.*** Poster/Abstract presented at CSTM (Canadian Society for Transfusion Medicine). April 20 – 23, 2017.
- L. Grabner. ***Diagnostic Services Website Redesign.*** Presentation at Canadian Blood Services Manitoba Hospital Blood Bank Education Day. May 24, 2018.
- R. Kaufman, A. Dinh, D. Lane, et al. ***Electronic Patient Identification for Sample Labeling Reduces Wrong Blood in Tube Errors.*** Transfusion, Volume 59, March 2019, pp 972-980.
- D. Lane. ***Transfusion Related Acute Lung Injury Versus Transfusion Associated Circulatory Overload.*** Presentation at Canadian Blood Services Manitoba Hospital Blood Bank Education Day. May 24, 2018.
- D. Lane. ***Advances in Perinatal Medicine: The Future is Here! Testing Maternal Plasma for Fetal DNA.*** Presentation at the Kenora Rainy River Regional Laboratory Symposium. September 21, 2018.
- D. Lane, ***TRALI-What It Is and How to Report It!*** Presentation Manitoba Blood Day. November 14, 2018.
- S. Ramirez-Arcos, M. Zeller, M. Fearon, J. Karlowsky, D. Alexander, D. Lane. ***Investigation of Septic Reaction in Two Pediatric Patients Involving a Double Apheresis Platelet Unit Contaminated with Staphylococcus Aureus.*** Poster presented at ISBT (International Society of Blood Transfusion). June 2, 2018.
- L. Richard, L. Beaudin, L. Meilleur, A. Al Khan, G. Clarke, A. Lewin, M. St-Louis. ***Report on the 19th International Society of Blood Transfusion Platelet Immunology Workshop.*** Presentation at ISBT (International Society of Blood Transfusion). June 2, 2018.

GOALS FOR 2019

A. Business Continuity Planning

Collaboration with Shared Health Diagnostics to ensure the Diagnostic Services plan meshes seamlessly with other plans will be a focus in 2019.

B. College of American Pathologists (CAP) Laboratory Accreditation

An on-site inspection of the Platelet Immunology Laboratory is anticipated to occur in the beginning of 2019.

C. LEAN Continuous Improvement of Red Cell Serology Laboratories – Staff Cross Training

Cross-training of staff to perform both pre-transfusion and perinatal testing will continue in 2019. The goal is to more efficiently use people's talents.

D. MMA Testing

When serologically compatible red bloods cells are not available for a patient with several or rare alloantibodies, the Monocyte Monolayer Assay (MMA) can help predict the survival of serologically incompatible red blood cells in vivo. Canadian Blood Services will be determining the feasibility of implementing the MMA in Edmonton, and the potential for offering it as referral test to transfusion medicine clinicians and facilities. A thorough assessment of the methodology and required equipment and reagents will be performed, and the viability of this project will be determined.

E. Preparation of Red Cell Aliquots for Neonatal and Pediatric Transfusion

Currently, red blood cell divided units containing approximately 125 to 150 ml are prepared by CBS Supply Chain operations in the Winnipeg Production Laboratory and are provided to the NICUs for transfusion to neonatal patients through the Winnipeg Crossmatch Laboratory. Aliquoting smaller, patient appropriate doses of red cells for neonate and pediatric transfusion is a service that has been long requested of CBS by the Neonatology Services in Winnipeg. A project group has been formed to implement the provision of smaller volume red cell aliquots prepared in the Red Cell Serology Laboratory. The target implementation date is December 2019.

F. Process Change for the Distribution of Components in eTraceLine

In collaboration with Shared Health Diagnostics, the process for distribution of blood components to eTraceLine facilities will change from using the Reserve/Transfer function to the Reserve/Issue function. This change is a quality improvement initiative to reduce distribution errors. Target implementation date is fall of 2019.