Canadian Blood Services

BLOOD
PLASMA
STEM CELLS
ORGANS
& TISSUES

DIAGNOSTIC SERVICES

ONTARIO

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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1. Senior Staff and Contact Information

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2. Red Cell Serology Reference Laboratory

The Red Cell Serology Reference Laboratory within Diagnostic Services provides testing for hospitals in the Central Ontario Region and Hamilton Region, and for private laboratories.

Testing Performed

The Reference Laboratory routinely performs the following tests:

- ABO/Rh blood type
- Screen for red blood cell antibodies
- Antibody Identification, if antibodies are detected
- Phenotyping (patient)
- Direct Antiglobulin Test
- Elution and Absorption

Serological samples submitted for testing are categorized into either “Prenatal Samples” or “Patient Samples”.

Antibody Screening and identification is routinely performed using a Gel Card testing methodology. A combination of Gel Card testing methodology and indirect antiglobulin tube testing using saline, enzymes or PEG enhancement are the most common antibody identification methods.

The laboratory also coordinates Red Cell Genotyping referral through the Canadian Blood Services National Immunohematology Reference Laboratory (NIRL). The Brampton laboratory is also responsible for maintaining the Central Ontario Sickle Cell Registry.

2.1. Specimens Tested

The data in this report reflects a calendar year period to enable better correlation to other government statistical data.

Table 1: Specimens Tested

Total Specimen Type	Test Type	2014	2015	2016	2017	2018
Patient Samples for Red Cell Serology Reference and Prenatal Samples	ABO resolutions	3	0	0	51	80
	Antibody investigations- pretransfusion	585	610	579	708	676
	Antibody investigations- prenatal	226	188	163	277	329
	Phenotyping (number of antigens)	2,248	2,074	1,952	2,776	2,874
Test Totals		3,873	3,651	2,694	3,812	3,959
Number of Patients Tested		728	716	670	987	1,015

Table 2: Samples Received Each Month

Sample Type	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18
Patient	59	53	60	55	66	50	55	69	49	58	60	51
Prenatal	16	19	24	23	27	32	45	30	35	28	25	26

The sample total for antibody investigations is 1,015 samples in 12 months or an average of 85 samples per month.

Hospital/Private Laboratory Referrals:

Samples referred into the Brampton Diagnostic Services Laboratory are from:

- 62 Health Care Facilities
- 3 Private Labs (Alpha, LifeLabs and Med-Health)

Private Labs are referring in primarily prenatal samples (90%) with only 10% patient samples for antibody investigation.

Alpha Laboratories Inc.	Prenatal	90	100	
	Patient	10		
LifeLabs	Prenatal	92	102	
	Patient	10		
Med-Health Laboratories Inc.	Prenatal	42	47	
	Patient	5		
			249	**Totals**
			224	**Prenatal**
			25	**Patient**

The hospital laboratories are referring in a combination of patient and prenatal samples for investigation.

Table 3: Total Number Samples with No Antibodies Detected

Prenatal	Patient	Total
59	45	104

Table 4: Total Number of Antibodies Detected in Prenatal Samples

Clinically Significant Antibodies - Identified	Number of Prenatal Investigation for each Antibody
Anti-D	14
Anti-C	3
Anti-C^w	1
Anti-c	14
Anti-E	23
Anti-e	2
Anti-G	2
Anti-Fya	8
Anti-Fyb	1
Anti-H	2
Anti-Jka	12
Anti-Jkb	2
Anti-Jk3	1
Anti-K	2
Anti-k	1
Anti-Lu^b	1
Anti-M	21*
Anti-S	3
Anti-U	1
Anti-Vel	1
Anti-Wra	1

* Note: only IgG anti M is clinically significant in pregnancy

Clinically Insignificant Antibodies-Identified	Number of Prenatal Investigation for each Antibody
Anti-Ch	2
Anti-Cob	1
Anti-Lea	13
Anti-Leb	6
Anti-P1	3
Anti-Rg	2
Anti-Yta	3
Autoantibody	12
Antibody to HLA Antigens	12
Cold Agglutinin	21
Unidentified	14
Passive Anti-D	69
Antibody to low prevalence antigen	2

Table 5: Prenatal Combination Antibodies

Multiple Antibody Combinations Identified	Number of Prenatal Multiple Antibody Investigation in 2018
Anti-c, Anti-E	3
Anti-c, Anti-Fya	1
Anti-c, Anti-E, Anti-Fyb	1
Anti-c, Anti-E, Anti-Fya	1
Anti-c, Anti-E, Anti-Jka	3
Anti-c, Antibody to HLA related antigen	1
Anti-C, Anti-D, Antibody to HLA related antigen	1
Anti-Cw, Anti-E	1
Anti-Ch Anti-Rg	2
Anti-D Anti-G	1
Anti-D, Anti-M	1
Anti-D & Antibody to HLA related antigen	1
Anti-E, Anti-Jka	1
Anti-E, Passive D	1
Anti-E, Autoantibody, Passive D	1
Anti-Fya, Anti-M, Anti-S, cold agglutinin	2
Anti-Fya, Antibody to HLA related antigen, passive D	1
Anti-Jka, Anti-Lea	1
Anti-Jka, Passive D	2
Anti-Jka, Anti-S, Autoantibody	1
Anti-Jka, Antibody to HLA antigen, Passive D	1
Anti-Jkb, autoantibody	1
Anti-Lea, Anti-Leb	2
Anti-Lea, Anti-M	2
Anti-S & Unidentified	1
Antibody to HLA related antigen & Passive D	2

Summary: In 2018 there were 36 antibody investigations for multiple antibodies with 26 different antibody combinations examined.

Table 6: Perinatal Patient Antibody Titres

Antibody	Critical Level	Non-Critical Level	Non-Critical to Critical
Anti-D	1	9	0
Anti-C	0	0	0
Anti-c	1	0	0
Anti-E	0	6	0
Anti-Ec	1	2	0
Anti-Fya	2	2	0
Anti-Jka	0	2	0
Anti-Jk3	1	0	0
Anti-M	0	2	0
Anti-U	0	2	0

Table 7: Number of Investigations for Antibodies Detected in Patient

Common Clinically Significant Antibodies in Patient Reference Samples	2018
Anti-D	32
Anti-C	36
Anti-c	42
Anti-E	85
Anti-e	15
Anti-f	5
Anti-G	4
Anti-K	65
Anti-M	15
Anti-S	20
Anti-s	1
Anti-Fya	28
Anti-Fyb	6
Anti-Jka	26
Anti-Jkb	8

Clinically Insignificant Antibodies in Patient Samples	2018
Anti-A1	3
Anti-Kna	2
Anti-Lea	9
Anti-Leb	8
Anti-McCa	1
Anti-N	1
Anti-P1	7
Anti-Rg	4
Anti-Sda	2
Anti-Yka	1
Anti-Yta	3
Autoantibody	196
Antibody to HLA Antigens	25
Cold Agglutinin	69
Unidentified	5

Table 8: Number of Investigations for Antibodies to Low Prevalence Antigens

Antibody	Number Identified
Anti-Cw	6
Anti-Dia	2
Anti-Jsa	2
Anti-Lua	11
Anti-Lu14	1
Anti-Kpa	10
Anti-Mia	1
Anti-SC2	3
Anti-V	4
Anti-Wra	13
Anti-Ytb	2
Antibody to low prevalence antigen	7

Table 9: Number of investigations for Antibodies to High Prevalence Antigens

Antibody	Number Identified
Anti-Ch	12
Anti-Coa	1
Anti-hrB	1
Anti-Jk3	2
Anti-k	2
Anti-Jsb	1
Anti-Kpb	1
Anti-Lub	4
Anti-LWa	2

Table 10: Number of Patient Investigation for a Combination Antibodies

Multiple Antibodies Detected	2018	Multiple Antibodies Detected	2018
Anti-D & HLA Related Antibody	1	Anti-C, Anti-Fya, Autoantibody	1
Anti-D Anti-C	4	Anti-C, Anti-e, Anti-Jka	1
Anti-D, Anti-M	1	Anti-C, Anti-K, Autoantibody	1
Anti-D, Antibody to Low Prevalence Antigen	1	Anti-C, Anti-Fya, Anti-K, Anti-V	1
Anti-D, Anti-G	1	Anti-C, Anti-E, Anti-Jka, Anti-K	1
Anti-D, Autoantibody	1	Anti-C, Anti-E, Anti-S, Anti-V, Autoantibody	1
Anti-D, Anti-E	2	Anti-c, Anti-Cw	1
Anti-D, Anti-Fya	1	Anti-c, Anti-Fya	2
Anti-D, Anti-Wra	1	Anti-c, Anti-K	2
Anti-D, Anti-C, Anti-Sc2	1	Anti-c, Anti-S	1
Anti-D, Anti-C, Anti-K	1	Anti-c, Anti-Jka, Autoantibody	1
Anti-D, Anti-K, & HLA Related Antibody	1	Anti-c, Anti-Jkb, cold agglutinin	1
Anti-D, Anti-C, Anti-Jka	1	Anti-c, Anti-K, Autoantibody	1
Anti-D, Anti-E, Autoantibody	1	Anti-c, Anti-Lub, Anti-K	2
Anti-D, Anti-C, Anti-E, Autoantibody	1	Anti-c, Anti-Lua, Anti-S	1
Anti-D, Anti-C, Anti-K, Anti-Lua	1	Anti-e, Anti-Fya	1
Anti-C, Autoantibody	6	Anti-e, Anti-M	1
Anti-C, Anti-e	2	Anti-E, Autoantibody	11
Anti-C, Anti-Fya	1	Anti-E, Anti-c	1
Anti-C, Anti-G	3	Anti-E, Anti-Cw	1
Anti-C, Anti-Kpa	1	Anti-E, Antibody to an HLA related antigen	1
Anti-C, Anti-e, Autoantibody	3	Anti-E, Anti-K	2

Multiple Antibodies Detected	2018	Multiple Antibodies Detected	2018
Anti-C, Anti-Jka, Autoantibody	2	Anti-E, Anti-Kpa	1
Anti-E, Anti-Kpb	1	Anti-S, Anti-Jkb, Anti-K	1
Anti-E, Anti-Rg	1	Anti-S, Anti-Fya, Anti-Jkb, Anti-Leb	1
Anti-E, Anti-S	1	Anti-Lea, Anti-Leb	5
Anti-E, Autoantibody, Antibody to HLA related antigen	1	Anti-K, Autoantibody	4
Anti-E, Anti-c, Autoantibody	6	Anti-K, Cold Agglutinin	1
Anti-E, Anti-c, Anti-Cw	1	Anti-K, Anti-Ch	1
Anti-E, Anti-Cw, Anti-Fyb	1	Ant-K, Anti-Jka	2
Anti-E, Anti-c, Anti-Jka	2	Anti-K, Anti-Jkb	1
Anti-E, Anti-c, Anti-S	1	Anti-K, Anti-Lua,	1
Anti-E, Autoantibody, Cold Agglutinin	1	Anti-K, Antibody related to HLA Antigen	1
Anti-E, Anti-Cw, Autoantibody	1	Anti-K, Unidentified Antibody	1
Anti-E, Anti-Fya, Anti-K	1	Anti-K, Autoantibody, Antibody related to HLA Antigen	1
Anti-E, Anti-Fya, Anti-Yka	1	Anti-K, Autoantibody, Cold Agglutinin	1
Anti-E, Anti-Fyb, Autoantibody	1	Anti-K, Anti-Fyb, Cold Agglutinin	1
Anti-E, Anti-Jka, Autoantibody	2	Anti-K, Anti-Jka, Cold Agglutinin	1
Anti-E, Anti-K, Anti-Lua	1	Anti-K, Anti-Kpa, Anti-Wra	2
Anti-E, Anti-K, Anti-Jkb	2	Anti-K, Anti-Fyb, Anti-Lua, Antibody to Low Prevalence Antigen	1
Anti-E, Anti-Lea, Anti-Leb	1	Anti-K, Anti-Kpa, Anti-Wra, Antibody related to HLA Antigen	2
Anti-E, Anti-S, Autoantibody	1	Anti-Kpa, Antibody related to HLA Antigen	1
Anti-E, Anti-c, Anti-Cw, Anti-K	1	Anti-Kpa, Anti-Jsa, Anti-Mia, Anti-Sc2, Anti-Wra	1
Anti-E, Anti-c, Anti-Fya, Antibody related to HLA Antigen	1	Anti-Lua, autoantibody	1
Anti-E, Anti-c, Anti-Fya, Anti-Ytb	1	Anti-Lub, Anti-Fya	1
Anti-E, Anti-c, Anti-Kpa, Anti-S	1	Anti-Fya, Anti-Coa	1
Anti-E, Anti-Dia, Anti-K, Anti-Wra	1	Anti-Fya, Antibody to Low Prevalence Antigen	1
Anti-E, Anti-Fya, Anti-M, Anti-S	1	Anti-Jka, Autoantibody	1
Anti-E, Anti-Fyb, Anti-Jka, Anti-Lua	1	Anti-Jkb, Cold Agglutinin	1
Anti-M, Cold Agglutinin	1	Anti-Dia, Cold Agglutinin	1
Anti-M, Anti-Jka	1	Anti-Wra, Cold Agglutinin	2
Anti-M, Anti-K	1	Anti-Wra, Passive D	1
Anti-S, Autoantibody	2	Anti-Wra, Antibody to Low Prevalence Antigen	1

Multiple Antibodies Detected	2018	Multiple Antibodies Detected	2018
Anti-S, Anti-Jka, Cold Agglutinin	1	Anti-Ch, Anti-Kna, Anti-McCa	1
Anti-Ytb, Antibody related to HLA Antigen	1	Anti-Sda, Cold Agglutinin	1
Anti-Ch, Anti-Rg	1		

Summary: In 2018 there were 161 antibody investigations for multiple antibodies with 113 different antibody combinations examined.

Table 11: Antibody Complex Procedures Performed

Procedures	Number of Prenatal Samples	Number of Referral Samples
Alloadsorption	0	70
Autoadsorption	8	92
Elution	8	175
Direct Coombs	206	551

3. Referral Samples

3.1. Specimens Tested

The Canadian Blood Services Platelet Immunology Laboratory in Winnipeg 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 post transfusion purpura (PTP). In 2018, there were 212 Platelet Donor Selections required for Ontario patients.

The tables below indicate the number of testing procedures performed to provide the optimal platelet products.

Table 12: HPA Typing/Antibody Screen Procedures performed by the CBS Platelet Immunology Laboratory in Winnipeg

Ontario Procedures	Number
HPA Antigen Typing	174
HPA Antibody Screen/ID	181

3.2. HLA Testing

Table 13: HLA procedures performed by CBS Platelet Immunology Laboratory in Winnipeg

Number of Ontario HLA Procedures 2018	
Procedures	**Number**
HLA Antigen SSP (Sequence Specific Primers) Typing	48
HLA SSO (Sequence Specific Oligonucleotide Probe) Antigen Typing	5
HLA Antibody Screen	37

3.3. Red Cell Genotyping

The BioArray BeadChip™ test system has been installed and validated in the Diagnostic Services Laboratory in Edmonton for RHD genotype testing used for the identification of RHD variants. The Edmonton CBS laboratory is accredited by the College of Physicians and Surgeons of Alberta (CPSA). Any patient samples requiring extended red cell genotype testing other than for D variant are referred to the National Immunohematology Reference Laboratory (NIRL) in Ottawa. NIRL performs extended genotype testing using the Progenika ID Core XT™ assay. If genotype test results are required urgently, testing results can be provided within 24 hours of the sample receipt.

Table 14: Genotype procedures referred by Canadian Blood Services

Number of Ontario Genotype Procedures 2018	
Procedures	**Number**
RHD Genotype Procedures	281
Non-RHD Genotyping	486

3.4. Red Cell Serological Reference Testing

The National Immunohematology Reference Laboratory (NIRL) in Ottawa is a highly specialized laboratory that focuses its attention on the identification and resolution of exceedingly complex red cell transfusion-related problems. The laboratory is accredited by the Institute of Quality Management in Healthcare (IQMH).

4. 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.

4.1. 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 Brampton 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 of 75% of samples to be tested and reported within 5 days of receipt. In 2018, 88% of the samples received were tested and reported within 5 days of receipt. This is an improvement over 2017 which was at 78%. Samples whose testing exceed the expected TAT are usually those where complex clinically significant antibodies are detected or where a referral to the National Immunohematology Reference Laboratory for additional investigation or genotype testing is required.

4.2. Rejected Specimens

The laboratory reserves the right to refuse improperly labelled specimens. Consistent practices for specimen rejection are employed across CBS. The laboratory takes measures to maintain specimen integrity during the process of following up on the receipt of an improperly identified specimen. The high number of specimens received by the laboratory makes it impossible to positively identify specimens that are not clearly labelled in accordance with standard specimen identification criteria. The specimen rejection rate in 2018 was 3.1% which is increased from the 1.2% in 2017.

4.3. Proficiency Testing

- **College of American Pathologists Survey Participation**
  This summary is based on all the College of American Pathologists (CAP) survey reports from the Brampton Diagnostic Services site. This summary includes all the blood group serology processes.

Table 15: CAP Proficiency Testing Results

Brampton Diagnostic Site (Red Cell)	2016 CAP Proficiency Results	2017 CAP Proficiency Results	2018 CAP Proficiency Results
ABO/Rh Type	100%	100%	100%
Antibody Titre	100%	100%	100%
Antibody Identification	100%	100%	100%
Antibody Identification Eluate	100%	100%	100%
Direct Coombs C3	100%	100%	100%
Direct Coombs IgG	100%	100%	100%
Unexpected Antibody Detected	100%	100%	100%

Table 16: IQMH Proficiency Testing Results

Brampton: QPMLS TMED	Kit #	Date Results Received	Results
Brampton	TMED-1803A Advanced	2018-05-10	100%
Brampton	TMED-1805A Advanced	2018-07-18	100%
Brampton	TMED-1809A Advanced	2018-11-15	100%

5. Accomplishments In 2018

A. Diagnostic Services Web Page Redesign completed on June 25th, 2018.

B. Initiated a project to implement Antigen Plus to assist staff in building exclusion antibody panels. Go-live is expected in April 2019.

C. Initiated the validation for new serological centrifuges and cell washers' models.

D. Abstract submitted and accepted for the International Society of Blood Transfusion conference titled "How Ethnic Donor Information Supports Requests for Transfusion".

E. Two technologists attended a "Red Cell Genotyping Workshop" in Bethesda Maryland.

F. 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 the 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.

6. Goals for 2019

A. Replace end of life testing equipment.

B. Implement new Antigen Plus software to track our rare frozen red cell inventory of reagent red cells and anti sera.

C. *MMA* Testing

When serologically compatible red blood 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 of 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.