Canadian Blood Services
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DIAGNOSTIC SERVICES

ONTARIO

YEAR IN REVIEW

JANUARY – DECEMBER 2017

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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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

Starting this year serological samples submitted for testing where 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	2013	2014	2015	2016	2017
Patient Samples for Red Cell Serology Reference and Prenatal Samples	ABO resolutions	0	3	0	0	51
	Antibody investigations- pretransfusion	557	585	610	579	708
	Antibody investigations- prenatal	217	226	188	163	277
	Phenotyping (number of antigens)	2,376	2,248	2,074	1,952	2,776
Test Totals		**3,924**	**3,873**	**3,651**	**2,694**	**3,812**
Number of Patients Tested		**701**	**728**	**716**	**670**	**987**

Table 2: Samples Received Each Month:

Sample Type	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17
Patient	63	53	55	52	68	71	56	75	65	56	41	55
Prenatal	23	32	30	25	28	20	21	25	23	22	12	17

The sample total is 987 samples in 12 months or an average of 82 samples per month for investigation.

Hospital/Private Laboratory Referrals:

Samples referred into the Brampton Diagnostic Services laboratory are from:

- 55 referring laboratories
- 2 Donor Testing labs (Brampton and Calgary)
- 4 Private Labs (Alpha, CML, LifeLabs and Med-Health)
- 49 Hospitals

The Donor testing labs referred 12 samples for anti-G investigation (2 from Calgary and 10 from Brampton).

Private Labs are referring in primarily prenatal samples (84%) and 16% patient samples for antibody investigation.

Alpha Laboratories Inc.	Prenatal	72	80	
	Patient	8		
CML Life Labs	Prenatal	2	2	
LifeLabs	Prenatal	0	0	
Med-Health Laboratories Inc.	Patient	1	3	
	Prenatal	2		
			85	**Totals**
			12	**Prenatal**
			73	**Patient**

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

Table 3: Total Number Samples Submitted with No Antibodies Detected in submitted:

Prenatal	Patient	Total
43	**81**	**124**

Table 4: Total Number of Antibodies Detected in Prenatal Samples submitted:

Clinically Significant Antibodies - Identified	Number of Prenatal Investigation for each Antibody
Anti-A1	2
Anti-D	14
Anti-Dantu	1
Anti-C	9
Anti-C^w	1
Anti-c	20
Anti-E	23
Anti-e	2
Anti-Fya	1
Anti-Fyb	2
Anti-G	5
Anti-Goa	1
Anti-Jka	1
Anti-Jkb	1
Anti-Jk3	1
Anti-K	4
Anti-Kp^a	1
Anti-Lu^b	6
Anti-M	15
Anti-S	8
Anti-U	1

Clinically Insignificant Antibodies-Identified	Number of Prenatal Investigation for each Antibody
Anti-Ch	2
Anti-Ge2	6
Anti-Kna	1
Anti-Lea	3
Anti-Leb	1
Anti-Lua	1
Anti-N	1
Anti-P1	1
Anti-Rg	3
Anti-Sc2	1
Anti-Vw	1
Anti-Yka	1
Anti-Yta	1
Autoantibody	11
Antibody to HLA Antigens	18
Cold Agglutinin	9
Unidentified	7
Passive Anti-D	125

Table 5: Prenatal Combination Antibodies:

Multiple Antibody Combinations Identified in Prenatal Samples	Number of Prenatal Multiple Antibody Investigation in 2017
Anti-C Anti-G	3
Anti-Ch Anti-Rg	2
Anti-D Anti-C	2
Anti-D & Antibody to HLA related antigen	1
Anti-D Anti-C Anti-G	2
Anti-Dantu & Cold Agglutinin	1
Anti-c & Autoantibody	1
Anti-c Anti-Fya	1
Anti-c & Antibody to HLA related antigen	1
Anti-c Anti-Cw & Antibody to HLA related antigen	1
Antibody to HLA related antigen & Passive D	2
Anti-Lub & Passive D	4
Anti-M Anti-S	2
Anti-M Anti-S & Passive D	2
Anti-S & Passive D	1
Anti-S & Unidentified	1
Anti-C Anti-e & Antibody to HLA related Antigen	1
Anti-Fyb Anti-Lub & Antibody to Low Prevalence Antigen	1
Anti-Jkb Anti-Lea Anti-Leb	1

Summary: In 2017 there were 30 antibody investigations for multiple antibodies with 19 different antibody combinations examined.

Table 6: Perinatal Patient Antibody Titres:

Antibody	Critical Level	Non-Critical Level	Non-Critical to Critical
Anti-D	2	4	0
Anti-C	1	0	0
Anti-c	0	1	0
Anti-E	0	3	0
Anti-e	1	0	0
Anti-Fya	1	0	0
Anti-Jka	0	1	0
Anti-M	0	1	0
Anti-S	0	1	0

Table 7: Number of Investigations for Antibodies Detected in Patient:

Common Clinically Significant Antibodies in Patient Samples	2017
Anti-D	31
Anti-C	31
Anti-c	35
Anti-E	98
Anti-e	10
Anti-f	6
Anti-K	58
Anti-M	18
Anti-S	16
Anti-s	6
Anti-Fya	29
Anti-Fyb	10
Anti-Jka	34
Anti-Jkb	6

Clinically Insignificant Antibodies in Patient Samples	2017
Anti-A1	1
Anti-IH	1
Anti-Kna	8
Anti-Lea	7
Anti-Leb	2
Anit-Lua	11
Anti-McCa	2
Anti-N	3
Anti-P1	5
Anti-Rg	3
Anti-Yka	1
Anti-Yta	6
Autoantibody	212
Antibody to HLA Antigens	26
Cold Agglutinin	48
Unidentified	23

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

Anti-Cw	13
Anti-Dantu	1
Anti-Kpa	7
Anti-McCd/Anti-Vil	1
Anti-SC2	4
Anti-VS	1
Anti-Wra	16

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

Antibody	Number Identified
Anti-Ch	16
Anti-Coa	2
Anti-hrB	1
Anti-Jk3	1
Anti-JMH	3
Anti-k	3
Anti-Kpb	1
Anti-Lub	2
Anti-LW	1
Anti-U	3
Anti-Yka	1
Anti-Yta	6
Antibody to High Prevalence Antigen unidentified	1
Warm Auto Antibody	1

Table 10: Number of Patient Investigation for a Combination Antibodies:

Multiple Antibodies Detected Patient Samples	Number in 2017	Multiple Antibodies Detected Patient Samples	Number in 2017
Anti-C & Autoantibody	1	Anti-K Anti-Lea	1
Anti-C Anti-e	1	Anti-K Anti-Kpa	1
Anti-C Anti-K	1	Anti-K Anti-Wra	2
Anti-c & Autoantibody	1	Anti-Kna Anti-Mca	3
Anti-Ch & HLA Related Antibody	1	Anti-Lea & Cold Agglutinin	1
Anti-Ch Anti-Rg	1	Anti-Lw & Unidentifed	1
Anti-D & HLA Related Antibody	1	Anti-N & Autoantibody	1
Anti-D Anti-C	5	Anti-N Anti-S	1
Anti-D Anti-Kpb	1	Anti-S & Autoantibody	1
Anti-D Anti-Jka	2	Anti-S & Unidentified	1
Anti-D & Cold Agglutinin	3	Anti-s & Autoantibody	2
Anti-E & Autoantibody	9	Anti-U Anti-M	1
Anti-E Anti-A1	1	Anti-U Anti-Cw	1
Anti-E Anti-c	9	Anti-Wra & Autoantibody	1
Anti-E Anti-Cw	1	Anti-Wra & Unidentified antibody	1
Anti-E & HLA related antibody	1	Anti-Yta & Unidentified	1
Anti-E Anti-Fya	2	Cold Agglutinin& Autoantibody	5
Anti-E Anti-Fyb	1	Cold Agglutinin & Unidentified	1
Anti-E Anti-Jka	7	Warm antibody & cold agglutinin	1
Anti-E Anti-S	1	Autoantibody & HLA related Antibody	1
Anti-E Anti-Wra	2	Anti-C Anti-Cw Anti-Wra	1
Anti-f Anti-Fya	1	Anti-C Anti-E & Autoantibody	1
Anti-f Anti-Fyb	1	Anti-C Anti-e & Autoantibody	4
Anti-f Anti-Jkb	1	Anti-C Anti-e & Cold Agglutinin	1
Anti-Fya Anti-Cw	1	Anti-C Anti-e & Unidentified	1
Anti-Fya Anti-Jka	1	Anti-C Anti-K & Autoantibody	1
Anti-Fya Anti-Lub	1	Anti-C Anti-K & Cold Agglutinin	1
Anti-Fyb Anti-S	1	Anti-c Anti-Cw Anti-Fyb	1
Anti-Fya & Unidentified	1	Anti-c Anti-Fya Anti-Jkb	1
Anti-Fya & Antibody to Low Prevalence Antigen	1	Anti-D Anti-C Anti-E	1
Anti-Jka Anti-Wra	1	Anti-D Anti-C Anti-Jka	1
Anti-K & Autoantibody	2	Anti-D Anti-C Anti-s	1
Anti-K Anti-c	1	Anti-D Anti-C & Unidentified	1
Anti-K Anti-Ch	1	Anti-D Anti-K & Autoantibody	1
Anti-K Anti-Cob	1	Anti-D Anti-M Anti-Jka	1
Anti-K Anti-e	3	Anti-Dia Anti-Lua & Autoantibody	1
Anti-K and HLA related antibody	1	Anti-E Anti-c & Autoantibody	3

Multiple Antibodies Detected Patient Samples	Number in 2017	Multiple Antibodies Detected Patient Samples	Number in 2017
Anti-K Anti-Jka	1	Anti-E Anti-c Anti-Cw	2
Anti-E Anti-c & HLA related antibody	3	Anti-K Anti-Lea Anti-McCd/Anti-Vil	1
Anti-E Anti-c Anti-Jka	1	Anti-K Anti-Lua Anti-M Anti-A1	1
Anti-E Anti-c Anti-Lua	1	Anti-K Anti-Rg & Unidentified	1
Anti-E Anti-c Anti-s	1	Anti-V Anti-Vw & Autoantibody	1
Anti-E Anti-Fya & Autoantibody	1	Anti-V Anti Wra & Autoantibody	1
Anti-E Anti-Fya Anti-s	1	Anti-D Anti-C Anti-K Anti-Fya	1
Anti-E Anti-Fyb Anti-Jkb	2	Anti-E Anti-C Anti-S & Autoantibody	1
Anti-E Anti-hrB & Autoantibody	1	Anti-E Anti-c Anti-Cw & Cold Agglutinin	1
Anti-E Anti-Jka & Cold Agglutinin	1	Anti-E Anti-c Anti-Fya Anti-M	1
Anti-E Anti-Jka Anti-s	1	Anti-E Anti-c Anti-Jka Anti-S	1
Anti-E Anti Jkb & Autoantibody	1	Anti-E Anti-c Anti-Lua & Autoantibody	1
Anti-E Anti-K & Autoantibody	1	Anti-E Anti-c Anti-K Anti-Kpa	1
Anti-E Anti-K Anti-Dia	1	Anti-E Anti-c Anti-K Anti-S	1
Anti-E Anti-K & HLA related antibody	1	Anti-E Anti-K Anti-Kpa & Autoantibody	1
Anti-E Anti-K Anti-Fya	1	Anti-K Anti-Fya Anti-Kpa Anti-Sc2	1
Anti-E Anti-K Anti-Kpa	1	Anti-S Anti-Wra & Unidentified & Cold Agglutinin	1
Anti-E Anti-Vw Anti-Wra	1	Anti-V Anti-Vs Anti-Wra Anti-Sc2	1
Anti-E Anti-K Anti-Wra	1	Anti-C Anti-Fya Anti-M & Autoantibody & Cold Agglutinin	1
Anti-Fya Anti-f Anti-Lua	1	Anti-D Anti-C Anti-E Anti-Jka & Autoantibody	1
Anti-Fya Anti-Lea & Cold Agglutinin	1	Anti-E Anti-c Anti-Cw Anti-Lea Anti-Jka	1
Anti-Fya Anti-S & Unidentified	1	Anti-E Anti-c Anti-Fyb Anti-Lua & Autoantibody	2
Anti-Fyb Anti-Jkb & Autoantibody	1	Anti-E Anti-Cw Anti-Jka Anti-K Anti-Anti-Lua & Cold Agglutinin & Autoantibody	1
Anti-Jka Anti-M & HLA related antibody	1	Anti-E Anti-Cw Anti-Jka Anti-K Anti-Anti-Lua & Cold Agglutinin & Autoantibody	1
Anti-K Anti-Cw & Autoantibody	1	Anti-E Anti-Cw Anti-Kpa Anti-Lua & HLA related Antibody	1
Anti-K Anti-Jka & Autoantibody	2	Anti-E Anti-Fya Anti-Jka Anti-K Anti-S & Unidentified	1

Summary: In 2017 there were 179 antibody investigations for multiple antibodies with 126 different antibody combinations examined.

Table 11: Antibody Complex Procedures Performed:

Procedures	Number of Prenatal Samples	Number of Patient Samples
Alloadsorption	4	66
Autoadsorption	9	90
Elution	8	197
Direct Coombs	276	706

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 platelet function disorders (PTP). In 2017 the laboratory performed 225 Platelet Donor Selections.

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:

Procedures	Number
HPA Antigen Typing	186
HPA Antibody Screen/ID	206

3.2. HLA Testing

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

Number of HLA Procedures 2017	
Procedures	**Number**
HLA Antigen SSP Typing	37
HLA SSO Antigen Typing	3
HLA Antibody Screen	40
Note: As of 2016 UHN performs routine HLA testing for the GTA. CBS only provides testing in STAT or complex cases	

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 Rh D 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 Brampton:

Number of Genotype Procedures 2016	
Procedures	**Number**
RhD Genotype Procedures	272
Non-RHD Genotype Procedures	43

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).

Table 15: Red cell serological investigations referred to NIRL by Canadian Blood Services Brampton:

Number of RSCI Procedures Referred to NIRL 2016	
Procedures	**Number**
Antibody Investigations	6

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 2017, 78% of the samples received were tested and reported within 5 days of receipt. Samples whose testing exceeds 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.

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 2017 was 1.2%.

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.

- **Changes to the Proficiency Testing Program 2017**
  In May 2017, the South-Central Ontario Diagnostic Services laboratory relocated from Brampton to Brampton.

In June 2017, Canadian Blood Services implemented the Quality Event Management process which replaced the non-conformance reporting process.

Table 16: CAP Proficiency Testing Results (Percent Acceptable):

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

Table 17: CAP Proficiency Testing Results (Percent Acceptable):

Brampton: QPMLS TMED	Kit #	Date Results Submitted / rec'd	Results
Brampton	TMED-1703 A Advanced	2017-05-04	100%
Brampton	TMED-1705A Advanced	2017-09-21	100%
Brampton	TMED-1709A Advanced	2017-11-15	100%

5. Accomplishments In 2017

- Successfully moved Diagnostic Services Operations from 67 College Street to the Brampton location in May 2017.
- Inspected by and obtained accreditation from the Institute for Quality Management in Healthcare Accreditation in November 2017.
- Diagnostic Services Web Page Redesign is nearing completion and is scheduled to go live in June 2018.
- Perinatal Advisory Committee.

The Perinatal Advisory Council meeting for 2017 was held in Brampton, Ontario on November 20th.

In addition to the Canadian Blood Services Testing group members, an invited hospital guest in 2017 was Dr. Oksana Prokopchuk- Gauk from the Saskatoon Health Region.

The PNAC meeting included a discussion of plans for conversion and standardization of work instructions across all patient testing sites. In addition, a number of ongoing standardization initiatives, including automated solid phase testing for detection of passive anti D, and an adjusted algorithm for RHD genotyping of prenatal patients were updated.

The process for implementation of new initiatives was outlined by the leadership group. This was followed by a presentation of commercially available software for cataloguing and tracking reagent red cells and antisera. This software provides a searchable database of reagent cells that could be viewed from any Canadian Blood Services laboratory across the country, potentially enhancing complex antibody identification in prenatal or pre-transfusion patients.

Non-invasive prenatal testing as a means of targeting antenatal Rh immune globulin to only those Rh (D) negative pregnant women who are carrying an Rh-positive fetus was also discussed as a potential future initiative.

6. Goals for 2018

1. Replace end of life testing equipment.
2. All Diagnostic Services sites (Vancouver, Edmonton, Winnipeg, Brampton) will continue to collaborate in the project to redesign and refresh the current Diagnostic Services webpages on www.blood.ca. The redesigned site with its' new features (Test Catalogue and QuickLinks), expanded information and functionality is anticipated to go live in spring of 2018.
3. Implement new software to track our rare frozen red cell inventory of reagent red cells and antiserums.