DIAGNOSTIC SERVICES

ONTARIO

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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RED CELL SEROLOGY REFERENCE LABORATORY

The Red Cell Serology Reference Laboratory, Ontario Diagnostic Services provides testing for hospitals in the Central Ontario Region and Hamilton Region, and for private laboratories. Hospital patients who are repeatedly transfused may develop red cell antibodies and as a result may have difficulty in tolerating transfusions. Diagnostic Services has specialized and experienced technologists that assist and provide consultation to hospital transfusion medicine laboratories. 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), Grifols Clinical Laboratory & Immunohematology Center and the New York Blood Center.

Diagnostic Services Red Cell Antibody Investigations

In 2020, hospitals have referred 1,417 requests for red cell antibody identification.

Referring hospitals have different capabilities and expertise in resolving red cell antibody investigations. Some hospitals have limited reagents for antibody identification or phenotyping of patient or donor units. Others have access to a wider variety of reagent red cell panels and methods as well as on site immunohematology expertise. A few hospital transfusion medicine laboratories have the resources to resolve the majority of serological problems and send only complex investigations for additional serological or genotyping studies.

Canadian Blood Services, Diagnostic Services provides consultation and testing support including antibody investigation, advanced or alternative techniques where required, and recommendations for compatibility testing methods and selection of appropriate donor unit phenotypes if necessary.

Reporting may include interim, final and supplemental reports, depending on the urgency of the testing, the need for patient transfusion and the complexity of investigation.

Testing Performed

The Red Cell Reference Laboratory routinely performs the following tests:

- ABO/Rh blood type and discrepancy investigations (if required)
- Screen for red blood cell antibodies
- Antibody Identification, if antibodies are detected
- Phenotyping (patient)
- Direct Antiglobulin Test
- Elution and Adsorption
- Other tests and techniques, as required.

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.

1.1. Specimens Tested

The data in this report reflects a calendar year period to enable better correlation to other government statistical data (Statistics Canada birth statistics).

Table 1: Specimens Tested

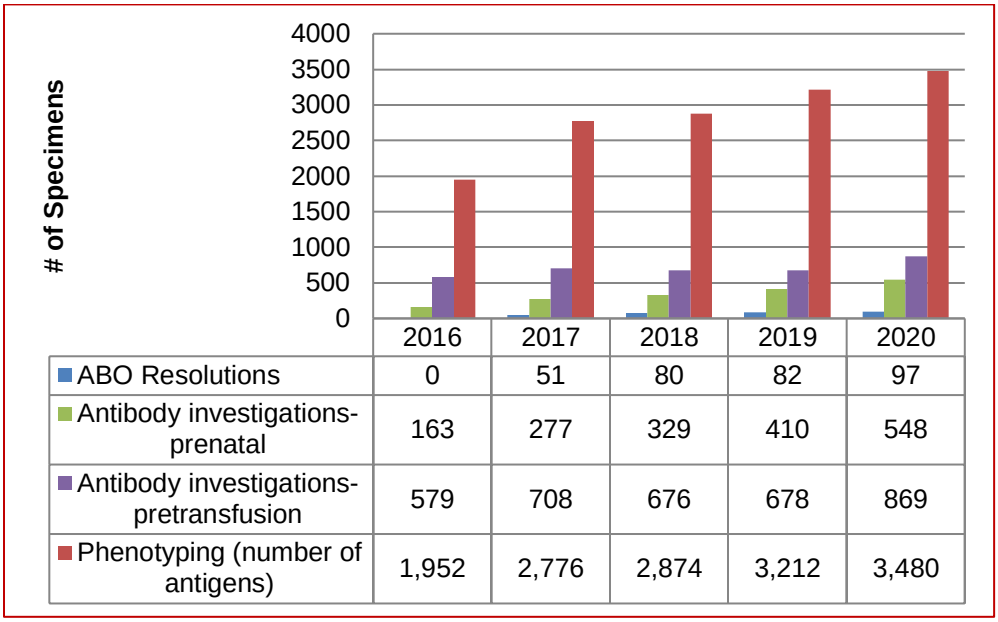
Ontario						
Specimen Type Patient Samples for Red Cell Serology Reference and Prenatal Samples	**Test Type**	**2016**	**2017**	**2018**	**2019**	**2020**
	ABO Resolutions	0	51	80	82	97
	Antibody investigations-pretransfusion	579	708	676	678	869
	Antibody investigations-prenatal	163	277	329	410	548
	Phenotyping (number of antigens)	1,952	2,776	2,874	3,212	3,480
Total # of Specimens Tested		**2,694**	**3,812**	**3,959**	**4,382**	**4,994**

Table 2: Samples Received Each Month

Sample Type	Jan-20	Feb-20	March-20	April-20	May-20	June-20	July-20	Aug-20	Sept-20	Oct-20	Nov-20	Dec-20
Patient	88	78	75	61	55	60	93	54	78	67	75	85
Prenatal	62	53	57	51	47	35	43	27	50	46	34	43

The sample total for antibody investigations is 1,417 samples in 12 months or an average of 118 samples per month.

Figure 1: Specimens Tested



	2016	2017	2018	2019	2020
ABO Resolutions	0	51	80	82	97
Antibody investigations-prenatal	163	277	329	410	548
Antibody investigations-pretransfusion	579	708	676	678	869
Phenotyping (number of antigens)	1,952	2,776	2,874	3,212	3,480

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 (94%) with only 6% patient samples for antibody investigation.

Table 3: Total Number Samples sent from Hospital/Private Laboratories

Alpha Laboratories Inc.	Prenatal	170	181	
	Patient	11		
LifeLabs	Prenatal	115	120	
	Patient	5		
Med-Health Laboratories Inc.	Prenatal	19	23	
	Patient	4		
			324	**Totals**
			304	**Prenatal**
			20	**Patient**

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

Table 4: Total Number Samples with No Antibodies Detected

Prenatal	Patient	Total
84	148	232

Table 5: Total Number of Antibodies Detected in Prenatal Samples

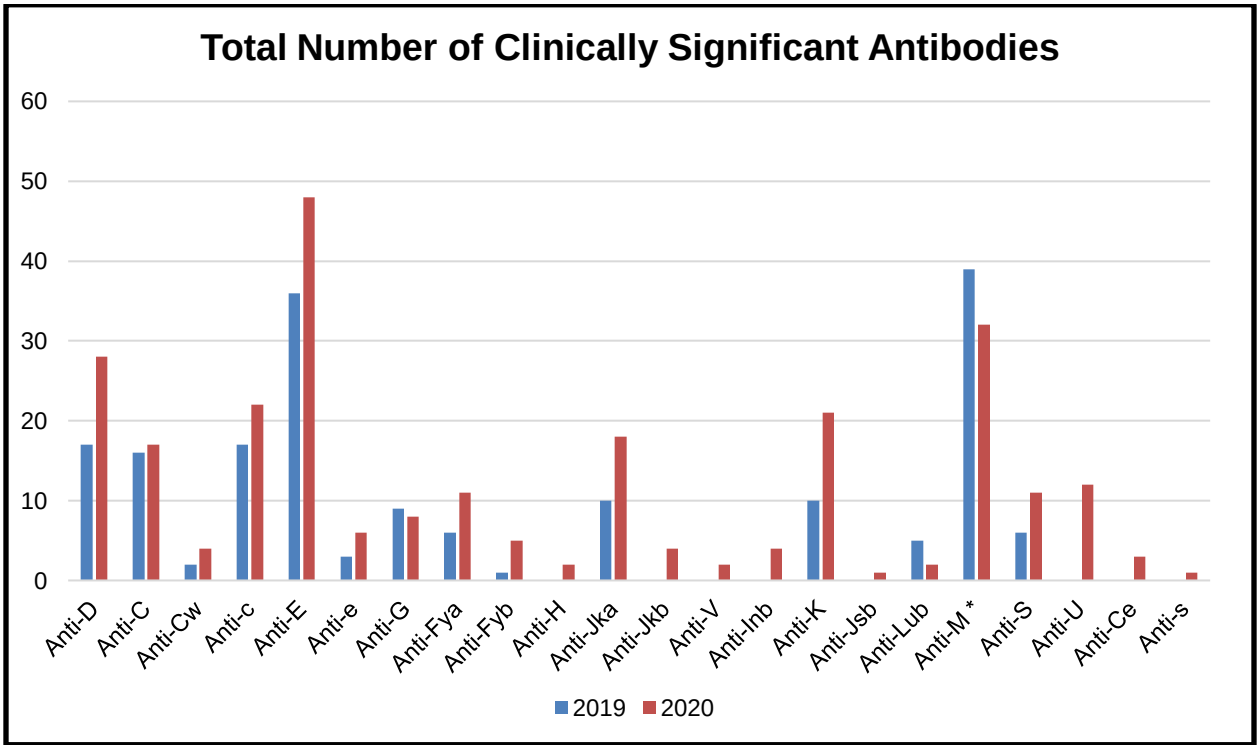
Number of Prenatal Investigation for each Antibody		
Clinically Significant Antibodies - Identified	**2019**	**2020**
Anti-D	17	28
Anti-C	16	17
Anti-Cw	2	4
Anti-c	17	22
Anti-E	36	48
Anti-e	3	6
Anti-G	9	8
Anti-Fya	6	11
Anti-Fyb	1	5
Anti-H	0	2
Anti-Jka	10	18
Anti-Jkb	0	4
Anti-V	0	2
Anti-Inb	0	4
Anti-K	10	21
Anti-Jsb	0	1
Anti-Lub	5	2
Anti-M *	39	32
Anti-S	6	11
Anti-U	0	12
Anti-Ce	0	3
Anti-s	0	1
Anti-hrB	0	1
Anti-hrS	0	1
Anti-Lua	0	1
Anti-Yta	0	1
Anti-Lu14	0	2

Clinically Significant Antibodies - Identified	2019	2020
Anti-Wra	0	6
Anti-PP1pk	0	1
Anti-Jra	0	2
Total	**177**	**277**

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

Clinically Insignificant Antibodies	2019	2020
Anti-Lea	14	5
Anti-Leb	8	6
Anti-P1	3	1
Autoantibody	8	35
Antibody to HLA Antigens	9	1
Cold Agglutinin	11	3
Unidentified	2	5
Passive Anti-D	43	104
Antibody to low prevalence antigen	1	1
TOTAL: Clinically Insignificant Antibodies	**99**	**161**

Figure 2: Total Number of Antibodies Detected in Prenatal Samples



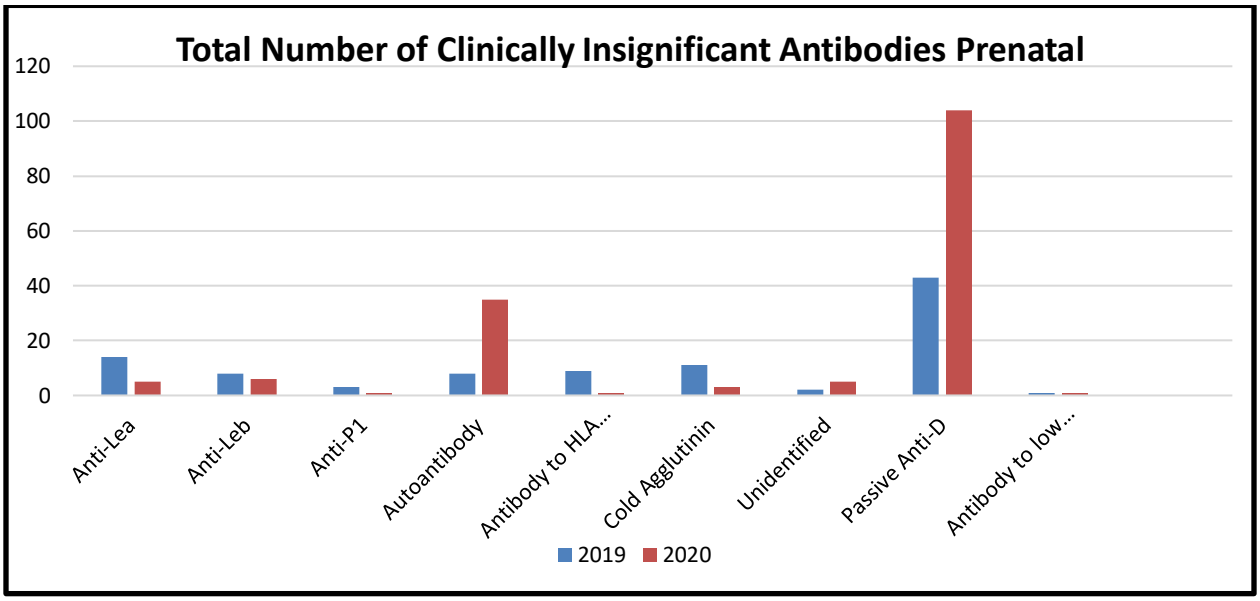


Figure 3: Frequency of Clinically Significant Antibodies

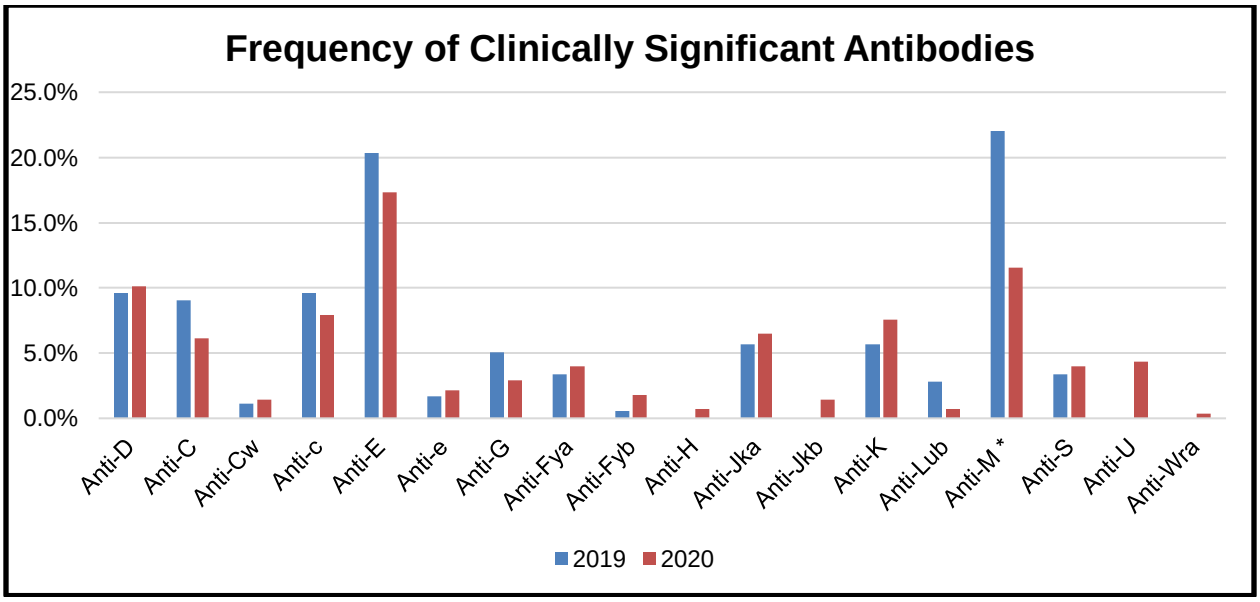


Table 6: Prenatal Combination Antibodies

Summary: In 2020 there were 46 antibody investigations for multiple antibodies with 36 different antibody combinations examined.

Multiple Antibody Combinations Identified	Number of Prenatal Multiple Antibody Investigation in (Current Year)
Anti-Jsb, Anti-E	1
Anti-s, Anti-D	1
Anti-c, Anti-Inb	1
Anti-Kpa, Anti-D	3
Anti-N, Anti-E	1
Anti-c, Anti-Jka	1
Anti-hrS, Autoantibody	1
Anti-C, Anti-E, anti-D	1
anti-M, Anti-c	2
Anti-C, Anti-Lea	1
Anti-Fyb, Anti-M	1
anti-M, anti-Jkb	2
Anti-S, Anti-c	1
Anti-G, Autoantibody	1

Multiple Antibody Combinations Identified	Number of Prenatal Multiple Antibody Investigation in (Current Year)
Anti-G, Anti-C	2
Anti-Leb, Anti-c	1
Anti-G, Anti-c	2
Anti-Jka, Anti-Lea	2
Anti-Jka, Anti-E	2
Anti-Jka, Anti-S, Autoantibody	1
Anti-c, Anti-Jra	1
Anti-Jkb, autoantibody	1
Anti-Lea, Anti-Leb	3
Anti-Wra, Anti-K, Anti-E	1
Anti-K, Autoantibody	1
Anti-S, Anti-Lea	1
Anti-S, Anti-D	1
Anti-C, Anti-M	1
Anti-K, Anti-Fyb, Anti-E	1
Anti-D, Anti-Cw	1
Anti-S, Anti-U	1
Anti-S, Anti-Lea	1
Anti-Jka, Anti-E	1
Anti-Jkb, Anti-K	1
Anti-E, Cold antibody	1
Anti-c, Anti-Lua	1

Table 7: Perinatal Patient Antibody Titres

Antibody	Critical Level	Non-Critical Level	Non-Critical to Critical
Anti-D	4	4	0
Anti-C	0	1	0
Anti-c	0	3	0
Anti-E	2	4	0
Anti-e	1	0	0
Anti-D, Anti-C	1	0	0
Anti-D, Anti-E	0	1	0
Anti-E, Anti-c	0	2	0
anti-G	0	1	0
anti-Fya	0	3	0
anti-C, anti-G	0	2	0

Antibody	Critical Level	Non-Critical Level	Non-Critical to Critical
anti-D, anti-G	0	2	0
anti-Jka	0	4	0
Anti-M	2	5	0
anti-S	0	1	0
Anti-s	0	2	0

Table 8: Number of Investigations for Antibodies Detected in Patient Reference Samples

Common Clinically Significant Antibodies in Patient Reference Samples	2020
Anti-D	16
Anti-C	35
Anti-c	33
Anti-E	97
Anti-e	13
Anti-f	2
Anti-G	2
Anti-K	48
Anti-M	13
Anti-S	21
Anti-s	2
Anti-Fya	29
Anti-Fyb	3
Anti-Jka	30
Anti-Jkb	16
Anti-U	2
TOTAL:	**362**

Clinically Insignificant Antibodies	2020
Anti-A1	3
Anti-Leb	2
Anti-McCa	1
Anti-N	2
Anti-P1	1
Anti-Rg	1
Anti-Yta	2
Autoantibody	223
Antibody to HLA Antigens	6
Anti-Xga	2
Cold Agglutinin	16
Unidentified	5
TOTAL: Clinically Insignificant Antibodies	**254**

Figure 4: Total Number of Clinically Significant Antibodies Detected in Patient Reference Samples

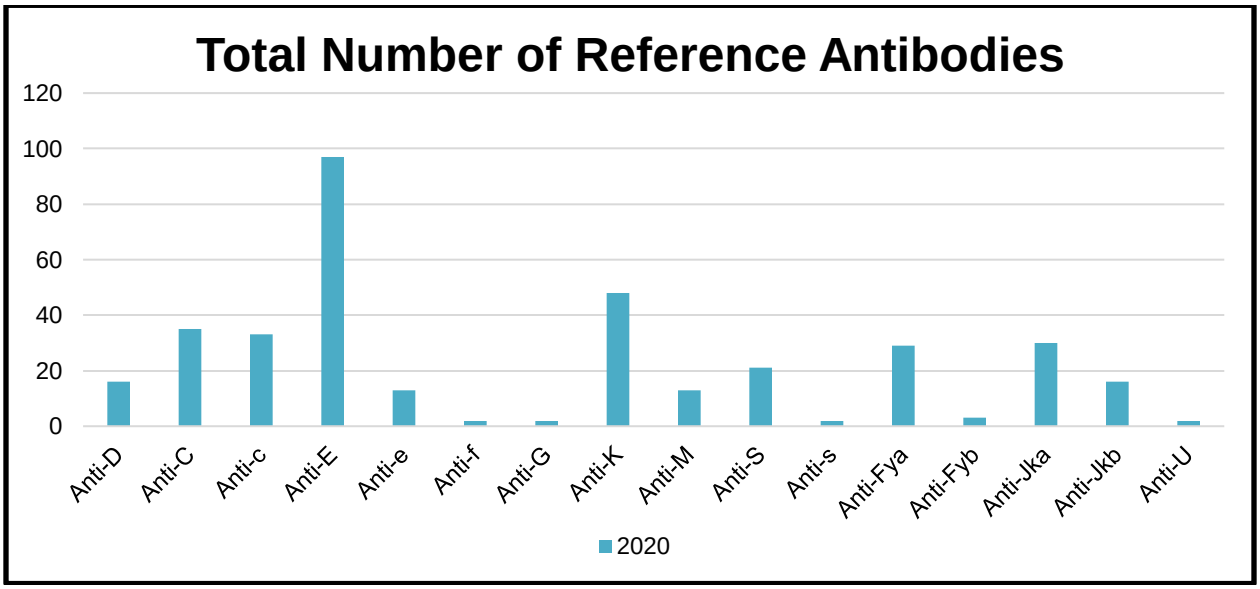


Figure 5: Frequency of Clinically Significant Antibodies in Patient Reference Samples (2020)

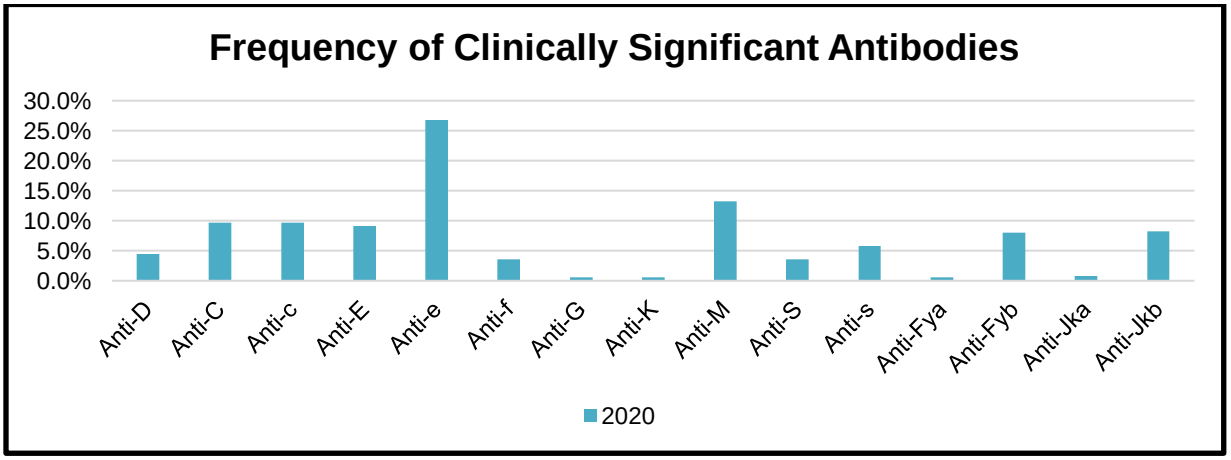


Table 9: Number of Investigations for Antibodies to Low Prevalence Antigens

Antibody	Number Identified
Anti-Cw	7
Anti-Dia	3
Anti-Jsa	1
Anti-Lua	5
Anti-Vs	1
Anti-Kpa	7
Anti-Mia	2
Anti-V	3
Anti-Wra	12
Antibodies to low prevalence antigen	**41**

Table 10: Number of investigations for Antibodies to High Prevalence Antigens

Antibody	Number Identified
Anti-Ch	2
Anti-H	3
Anti-hrB	3
Anti-Jk3	2
Anti-Fy3	2
Anti-Kna	1
Anti-Kpb	1
Anti-Jra	1
Anti-Cob	2
Anti-LWa	1
anti-Ge2	1
Antibodies to high prevalence antigen	**19**

Table 11: Number of Patient Investigation for a Combination Antibodies

Multiple Antibodies Detected	2020	Multiple Antibodies Detected	2020
Anti-E, Anti-S, Anti-K, Anti-Kpa, Anti-Jka, Autoantibody	1	Anti-C, Anti-D, Anti-S, Anti-Jkb, Autoantibody	1
Anti-LW, Autoantibody	1	Anti-D, Autoantibody	1
Anti-D, Anti-C, Anti-Fya	1	Anti-D, Anti-C, Anti-K	2
Anti-C, Autoantibody	3	Anti-E, Anti-S	3
Anti-E, Anti-Jka	1	Anti-E, Anti-K, Autoantibody	4
Anti-D, Anti-C	2	Anti-C, Anti-Doa, Anti-hrB, Autoantibody	1
Anti-S, Anti-Fyb	1	Anti-C, Anti-E, Anti-Kpa, Anti-Wra, Autoantibody	1
Anti-C, Antibody Related to HLA Antigen	1	Anti-E, Anti-c, Anti-Wra	1
Anti-C, Anti-e	4	Anti-E, Anti-Jkb	1
Anti-E, Anti-K, Anti-Kpa	1	Anti-C, Anti-E, Autoantibody	2
Anti-D, Anti-Fya	1	Anti-D, Anti-G	1
Anti-E, anti-c	5	Anti-Jka, Autoantibody	9
Anti-Cw, Anti-S, Anti-Jkb	1	Anti-E, Anti-c, Anti-Kpa, Anti-Jkb	1
Anti-c, Anti-E, Autoantibody	4	Anti-c, Anti-Fya	1
Anti-K, Autoantibody	3	Anti-c, Anti-M	1
Anti-K,Anti-E, Anti-c, Autoantibody	1	Anti-E, Anti-S, Anti-Fya, Anti-Jkb	1
Anti-E, Antibody Related to HLA Antigen	1	Anti-c, Anti-M	1
Anti-Fya, Anti-Jkb	1	Anti-c, Anti-Fya, Anti-Jka	1
Anti-E, Anti-Cw, Autoantibody	1	Anti-c, Anti-Jkb	1
Anti-C, Anti-E, Anti-Kpa, Anti-Wra, Autoantibody	1	Anti-D, Anti-C, Autoantibody	2
Anti-K, Anti-Fya	2	Anti-E, Anti-c, Anti-K	2
Anti-E, Anti-K	3	Anti-E, Autoantibody	7
Anti-E, Anti-S	1	Anti-K, Autoantibody	1
Anti-f, Anti-M, Anti-Jkb	1	Anti-C, Anti-V	1
Anti-K, Anti-Lua, Anti-Jka, Autoantibody	1	Anti-K, Anti-Kpa, Cold Antibody	1
Anti-E, Anti-Kpa	1	Anti-s, Anti-Fya, Anti-Jka	1

Multiple Antibodies Detected	2020	Multiple Antibodies Detected	2020
Anti-C, Anti-S	1	Anti-K, Anti-Jka	1
Anti-Cw, Anti-Cob	1	Anti-E, Anti-Jka	1
Anti-E, Anti-Jka, Anti-c	1	Anti-E, Anti-c, Anti-Fya, Autoantibody	1
Anti-C, Anti-K	1	Anti-C, Anti-Jkb	1
Anti-Cw, Anti-Jsa, Anti-Wra, Antibody to HLA Related Antigen	1	Anti-D, Anti-S, Anti-Fya	1
Anti-Cob, Autoantibody	1	Anti-Cw, Anti-Wra	1
Anti-S, Anti-Fya	1	Anti-E, Anti-S, Anti-Fya	1
Anti-S, Autoantibody	1	Anti-M, Anti-S, Anti-Fy3, Anti-Jkb	1
Anti-E, Anti-c, Anti-Wra	1	Anti-G, Anti-C	1
Anti-E, Anti-c, Anti-K, Anti-Lua	1	Anti-s, Anti-Jkb	1
Anti-E, Anti-K, Anti-Mia	1	Anti-E, Anti-Fya, Anti-Jkb	1
Anti-N, Anti-K, Anti-Fyb, Cold Antibody	1	Anti-hrB, Autoantibody	1
Anti-E, Anti-Cw, Autoantibody	1	Anti-E, Antibody to HLA Related Antigen	1
Anti-c, Anti-Jka	1	Anti-C, Autoantibody	1
Anti-C, Anti-Fya	2	Anti-e, Anti-Fya	1
Anti-C, Anti-K, Autoantibody	1	Anti-E, Anti-Fya	1
Anti-E, Anti-S, Anti-K	1	Anti-M, Anti-Jra	1
Anti-e, unidentified antibody	1	Anti-E, Anti-U	1
Anti-E, Anti-V	1	Anti-S, Anti-f	1
Anti-E, Anti-K, Anti-Dia	1		

Summary: In 2020 there were 133 antibody investigations for multiple antibodies with 89 different antibody combinations examined.

Table 12: Antibody Complex Procedures Performed

Procedures	Number of Prenatal Samples	Number of Referral Samples
Autoadsorption	0	45
Alloadsorption	9	251
Elution	75	175
Direct Coombs	476	757

REFERRAL SAMPLES

1.2. 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 Brampton. 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 13: Genotype procedures referred by Canadian Blood Services

Number of Ontario Genotype Procedures 2020	
Procedures	**Number**
RHD Genotype Procedures	607
Non-RHD Genotyping	1125

1.3. Red Cell Serological Reference Testing

The National Immunohematology Reference Laboratory (NIRL) in Brampton 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).

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.

1.4. 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 2020, 79% of the samples received were tested and reported within 5 days of receipt. 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.

1.5. 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 2020 was 1.4% which is decreased from the 2.1% in 2019.

1.6. 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 14: CAP Proficiency Testing Results

Brampton Diagnostic Site (Red Cell)	2018 CAP Proficiency Results	2019 CAP Proficiency Results	2020 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 15: IQMH Proficiency Testing Results

Brampton: TMED	Kit #	Date Results Received	Results
Brampton	TMED-2003-A Advanced	2020-03-10	100%
Brampton	TMED-2006-A Advanced	2020-06-02	100%
Brampton	TMED-2009-A Advanced	2020-09-15	100%

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