



## 13<sup>th</sup> Annual Canadian Blood Services International Symposium

*Blood-Borne Pathogens: Defend, Detect, and Destroy*

**PERMISSION TO USE:** Please note that, by making their presentations available on-line, primary authors have agreed to share their presentations. However, should you want to use some of the data or slides for your own presentations, we request that you contact the primary author for permission.



# The Technical Aspects of Pathogen Testing in Canada

Nancy Angus  
Canadian Blood Services  
Director, Testing  
2015-09-26



## The Technical Aspects of Pathogen Testing in Canada

# Conflict of Interest Disclosures

## Nancy Angus

- I have not had, in the past 5 years, a financial interest, arrangement or affiliation with one or more organizations that could be perceived as a direct or indirect conflict of interest in the content of this presentation.



3

## The Technical Aspects of Pathogen Testing in Canada

# Outline

- Overview of Canadian Blood Services Testing
- Laboratory tests currently in use by blood operators, and in particular by Canadian Blood Services, for the detection of blood-borne pathogens
- Summarize the differences in sensitivity of the currently laboratory tests for blood-borne pathogens
- Long term horizon for Transmissible Diseases testing at Canadian Blood Services
- CBS planning to implement a new test



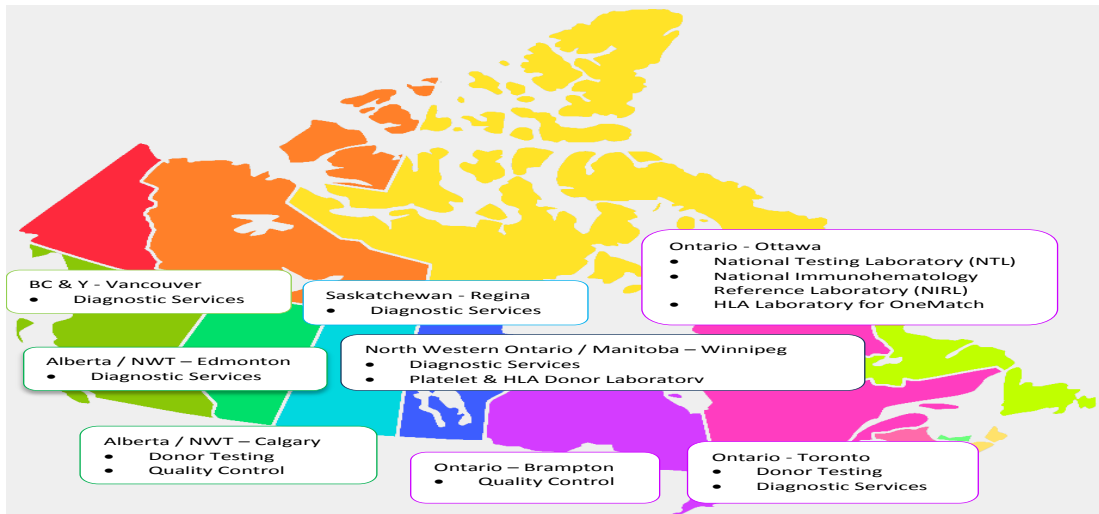
4

# Over View of Testing at Canadian Blood Services



## Overview of Testing at Canadian Blood Services

### Testing Sites



## Overview of Testing at Canadian Blood Services

### Testing at Canadian Blood Services

- Effective July 2014, all Testing service moved into one management structure reporting into Ian Mumford, Chief Supply Chain Officer and indirect accountability to Dana Devine, Chief Medical and Scientific Officer
- This included the following testing sites:
  - Donor Testing ( Calgary and Toronto)
  - Diagnostic Services ( BC/Y, Edmonton, Regina, Winnipeg and Toronto)
  - National Testing Laboratory( Ottawa)
  - National Reference Laboratories ( Red Cell –Ottawa, Platelet/HLA –Winnipeg)
  - QC Product Laboratories (Toronto and Calgary)
  - HLA laboratory ( Stem Cell and Cord – Ottawa)



7

## Overview of Testing at Canadian Blood Services

### Testing at Canadian Blood Services

Moving towards one management structure for all the laboratories at Canadian Blood Services would provide many benefits. These benefits include the following:

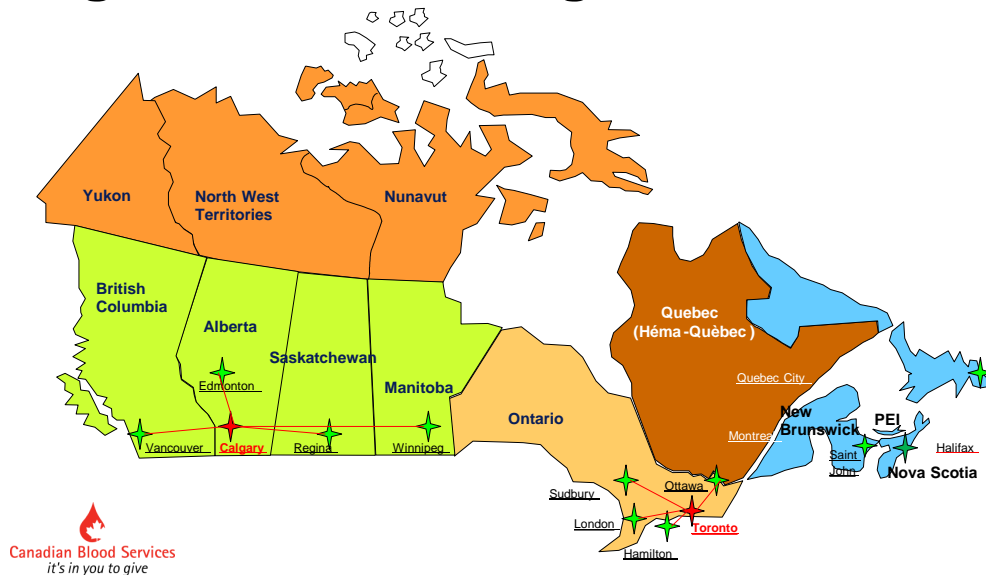
- Aligning of medical and technical expertise that are in low supply
- Making better use of expensive equipment and information systems
- Greater standardization in laboratory best practise
- Creates a work environment that facilitates recruitment, retention and mentorship of staff
- Opportunity for staff to learn new skills



8

## Overview of Testing at Canadian Blood Services

# Regional Donor Testing Sites



9

## Overview of Testing at Canadian Blood Services

# Transformation of Donor Testing

In September 1998, CBS took over the responsibility for the blood supply in 9 provinces and 3 territories outside Quebec

- CBS responsible for 13 Centres
- Each performed all mandatory testing for the collections in their area
- Testing reported to each individual Centre Director and Medical Director

10

## Overview of Testing at Canadian Blood Services

# Transformation of Donor Testing

- Consolidation of testing completed
  - Two site model located in Calgary, Toronto
- Based on ability to transport samples to location reliably during routine and contingency conditions.
- Next phase is two new facilities in Toronto and Calgary



11

## Overview of Testing at Canadian Blood Services

# Donor Testing Sites

Testing Site	Collection Site
Toronto 60% workload	Toronto, Ottawa, Hamilton, London, NS/PEI, New Brunswick and Newfoundland/Labrador samples
Calgary 40% workload	Edmonton, Calgary, Saskatoon, BC & Y, Regina and Winnipeg samples



12

## Overview of Testing at Canadian Blood Services

### Donor Testing Sites

- Each site is a mirror image for equipment and are back up for each other for business continuity issues
- Equipment at each site:
  - Four PK7300 instruments
  - Four NEO instruments
  - Three PRISM instruments
  - Four Roche s201 clusters per site for NAT and WNV testing



13

**Laboratory tests currently in use by blood operators, and in particular by Canadian Blood Services, for the detection of blood-borne pathogens**



## The Technical Aspects of Pathogen Testing in Canada

# CBS Testing Menu

Mandatory		Non-Mandatory
Test	Date Introduced	
ABO/ Rh, Antibody Screen	1947	<input type="checkbox"/> Antibody identification for donors with positive antibody screen
Syphilis	1949	
HBsAg	1972	<input type="checkbox"/> Phenotyping <input type="checkbox"/> Identifies additional antigens present or absent on red cells
Anti-HIV	1985	
HTLV I/II	1990	<input type="checkbox"/> CMV <input type="checkbox"/> CMV Negative products required by some immunodepressed patients
Anti-HCV	1990	
HCV NAT	1999	
HIV NAT	2001	
WNV NAT	2003	
Anti HBc	2005	
Chagas	2010	

## What Transmissible Diseases tests do we perform on Donor Samples?

Testing for:	Serological/NAT	Implementation
HIV 1/2	Antibody and NAT	1985 and 2001
HBV	HBsAg, Anti-HBc and NAT	1972, 2005 and 2011
HCV	Antibody and NAT	1990 and 1999
HTLV I/II	Antibody	HTLV I 1990, both 1998
WNV	NAT	2003, Seasonal 2015
Syphilis	Antibody	1949
CMV	Antibody (selected units)	1984
Chagas	Antibody (selective testing based on risk)	2010



## Overview of Testing at Canadian Blood Services

# Screening versus Confirmatory

Donor Testing performs mandatory screening tests

- If donation reactive (initial reactive (IR)), then sample tested x 2
- If donation reactive on  $\geq 2$  tests, donor repeat reactive (RR)
- Supplemental/confirmatory testing performed to determine if donor is a “true” positive
- Donor notification and counselling based on final test results



17

## Transmissible Diseases Serological Testing

### • Abbott PRISM® Platform:



*The ABBOTT PRISM® screens donated blood in over 30 countries, processing more than 40 percent of the global blood supply.*

Health Canada approved  
Chemiluminescent assays used to  
detect:

- HBsAg
- Anti-HBc
- Anti-HIV1/2
- Anti-HTLV I/II
- Chagas Antibody



18

## Transmissible Diseases Serological Testing

### • Beckman Coulter PK®7300 Platform:



Health Canada approved assays used to detect:

- Syphilis Antibody (Microhemagglutination Assay)
- CMV Antibody (Passive Particle Agglutination Assay)

19

## NAT Platform

### • Roche cobas ®s201 System:



Health Canada approved RT-PCR assays used to detect:

- HIV-1 RNA (Groups M and O)
- HIV-2 RNA
- HCV RNA
- HBV DNA
- WNV RNA



20

# Current Assays and Sensitivity used to perform Transmissible Diseases Testing at Canadian Blood Services



## Transmissible Diseases Serological Assays Performed on the PRISM Platform

Marker	Assay	Sensitivity Claim in Current Package Insert Version
HBsAg	Abbott <b>PRISM® HBsAg</b> , Antibody to Hepatitis B Surface Antigen (Mouse Monoclonal IgM), Abbott Laboratories, Diagnostics Division	Subtype <i>ad</i> = 0.10 ng/mL Subtype <i>ay</i> = 0.08 ng/mL
Anti-HBc (IgM and IgG)	Abbott <b>PRISM® HBcore</b> , Hepatitis B Virus Core Antigen (E.Coli, Recombinant), Abbott Laboratories, Diagnostics Division	Assay: 99.49% (95% CI 98.82% to 99.83%) Analytical: <0.8 PEI Units/mL (Paul Ehrlich Institute)
Anti-HCV	Abbott <b>PRISM® HCV</b> , Hepatitis C Virus encoded Antigens (Recombinant c100-3, HCr43, NS5), Abbott Laboratories, Diagnostics Division	Assay: 100% (95% CI 99.49% to 100%)
Anti-HIV 1&2	Abbott <b>PRISM® HIV O Plus</b> , Human Immunodeficiency Virus Types 1 and 2 (E.coli, B. megaterium, Recombinant) Antigen and Synthetic Peptide, Abbott Laboratories, Diagnostics Division	Assay: 100% (95% CI 99.56% to 100%)
Anti-HTLV I/II	Abbott <b>PRISM® HTLV-I/HTLV-II</b> , Human T-Lymphotropic Virus Types I and II Antigen (Inactivated), Abbott Laboratories, Diagnostics Division	Assay: 100% (95% CI 99.48% to 100%)
Chagas Antibody	Abbott <b>PRISM® Chagas</b> , <i>Trypanosoma cruzi</i> (E coli, Recombinant) Antigen, Abbott Laboratories, Diagnostics Division	Assay: 98.47% (95% CI 94.59% to 99.81%)



All assays are Health Canada and FDA approved.

22

## Transmissible Diseases Serological Assays on the PK7300 Platform

Marker	Assay	Sensitivity Claim in Package Insert
Syphilis Antibody	Beckman Coulter® <b>PK® TP System</b> , Microhemagglutination Test for Detection of <i>Treponema pallidum</i> Antibodies using the Beckman Coulter PK® Instrument, Beckman Coulter, Inc.	EDTA Plasma: EDTA Plasma: 100% (CI 0.555-0.97)
CMV Antibody	Beckman Coulter® <b>PK® CMV-PA System</b> , Passive Particle Agglutination Test for Detection of <b>Total</b> Cytomegalovirus Antibodies using the Beckman Coulter PK® Instrument, Beckman Coulter, Inc.	Serum: 99.40% (95% Lower Conf. Bound) EDTA Plasma: 99.93% (95% Lower Conf. Bound)



Both Assays are Health Canada and FDA approved.

23

## NAT Assays Performed on the s201 Platform – MPX 2.0

Marker	Assay	Pool Size	Sensitivity Claim in Package Insert
HIV-1 Group M RNA, HIV-1 Group O RNA, HIV-2 RNA, HCV RNA, HBV DNA	cobas® TaqScreen MPX Test, version 2.0, for use on the cobas s201 system, Roche Molecular Systems	Donor Samples are screened in Pools of 6.	Single Unit Limit of Detection (LOD): HIV-1M: 50.3 IU/mL HIV-1 O: 18.3 copies/mL HIV-2: 57.4 copies/mL HCV: 6.8 IU/mL HBV: 2.3 IU/mL  Theoretical sensitivity for a Pool of 6 by multiplying each Single Unit LOD by 6, this represents concentration of the sample, not true sensitivity



MPX 2.0 Assay is Health Canada and CE approved

24

## NAT Assays used on the s201 Platform - WNV

Marker	Assay	Pool Size	Sensitivity Claim in Package Insert
WNV RNA	cobas® TaqScreen West Nile Virus Test for use on the cobas s 201 system, Roche Molecular Systems	Donor Samples are screened in Pools of 6. Single Unit Testing is evoked when a positive donation is identified	Single Unit: 40.3 copies/mL (95% LOD)  Pool of 6: represents concentration of the sample of 241.8 copies/mL, this is a calculated "theoretical" sensitivity



WNV Assay is Health Canada and FDA approved

25

**Platforms currently used  
to perform Transmissible  
Diseases Testing in other  
blood agencies**



## Immucor NEO Platform



Health Canada approved assay to detect:

- Syphilis Antibody
  - Capture®-S, *Solid Phase System for the Serological Detection of Syphilis in Blood Donors*
- CMV Antibody
  - Capture-CMV®, *Solid Phase System for the Detection of IgG & IgM Antibodies to Cytomegalovirus (CMV)*

27

## Grifols Tigris Platform



Health Canada approved RT-PCR assays to detect:

- HIV RNA, HCV RNA, HBV DNA
  - *Procleix Ultrio assay*
- WNV RNA
  - *Procleix West Nile Virus (WNV) Assay*

28

# Transmissible Diseases Confirmatory Testing



## The Technical Aspects of Pathogen Testing in Canada

### Transmissible Diseases Confirmatory Testing Menu

- Performed at Canadian Blood Services:
  - Performed at the Donor Testing sites
    - *HBsAg Neutralization Assay on the PRISM Platform*
  - Performed at the National Testing Laboratory in Ottawa
    - *HCV Immunoblot*
    - *HIV-1 Western Blot (WB)*
    - *HIV-2 WB*
    - *HIV-2 EIA*
    - *HTLV I WB*
    - *HTLV II WB*
    - *Anti-HBs (Supplemental)*

## The Technical Aspects of Pathogen Testing in Canada

### Transmissible Diseases Confirmatory Testing Menu

- Performed outside of Canadian Blood Services:
  - Syphilis Confirmatory Testing performed at Provincial Public Health Laboratories:
    - *Alberta PH (Western Canada samples) – RPR, EIA, Immunoblot*
    - *Ontario PH (Eastern Canada samples) – RPR,TP.PA, FTA-Antibody*
  - Chagas Confirmatory Testing performed at National Reference Centre for Parasitology (NRCP) in Montreal:
    - *ELISA*
    - *Immunoblot*

**On the horizon for  
 Transmissible Diseases  
 (TD) Testing.....**



## The Technical Aspects of Pathogen Testing in Canada

### On the Horizon...

- Seasonal WNV Testing at Canadian Blood Services
  - Implementation at the end of November 2015
- Hepatitis E NAT
- CMV NAT
- Testing for Babesiosis
- Next Generation NAT Platform



33

## Implementation of a New Assay



## The Technical Aspects of Pathogen Testing in Canada

# Implementation of a New Assay

- Health Canada licensed assay and equipment
- Must be licensed for Donor Screening – end labeling of donor products
- Pre work of decision document and policy TD algorithms documents
- After decisions have been made by EMT , it usually take approximately 18 months to implement the new assay or system



35

## The Technical Aspects of Pathogen Testing in Canada

# Implementation of a New Assay

- Testing is supported by two Testing Process Development groups
  - Blood Group Serology
  - Transmissible Disease
- Each group is lead by an Associate Director
- These groups provide technically and project management to the Testing sites



36

## The Technical Aspects of Pathogen Testing in Canada

# Implementation of a New Assay

- First steps are always the purchase of test bed instrument
- Validation plan
- IT impacts- usually changes to ePROGESA
- This allows for validation scripts , procedures and training material to be developed
- An IOQ is performed on one instrument
- There is an submission to Health Canada (HC) which will includes; executive summary, training and validation summary



37

## The Technical Aspects of Pathogen Testing in Canada

# Implementation of a New Assay

- After permission to proceed from HC an IPQ script is tested on each test system
- Depending on the scope of the project they may be an logistic continuity plan developed for shipping sample to other site
- Training will take place two months before implementation
- Go- Live meeting
- Implementation and CELEBRATION!!!!!!!!!!!!!!



38

The Technical Aspects of Pathogen Testing in Canada

## SPECIAL ACKNOWLEDGEMENTS

- Donor Testing Staff
- Donor Testing Management team
- National Testing Process Staff
- Medical Staff
- Validation and Quality Staff



**Thank  
You!!!**

www.thebodytransformation.com



39



**Canadian Blood Services**  
*it's in you to give*

40