Investigating the Impact of Donor Characteristics on Blood Product Quality

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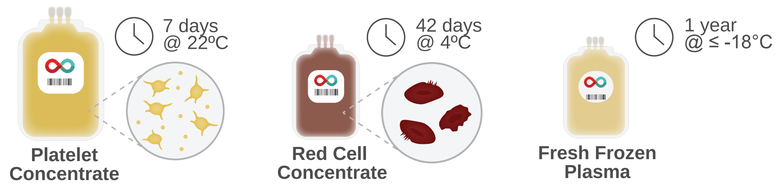
Background

Changes to Canadian Blood Services (CBS) Donor Eligibility Criteria

In Canada, there is **no upper age limit** for blood donors and as of March 2021, most **individuals with diabetes are eligible** to donate blood.

Since blood products are not standardized like other therapeutics, we need to **ensure that older or diabetic donors provide blood products of similar quality to younger, healthier donors.**

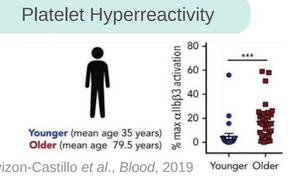
Storage Times and Resulting Lesions to Blood Products



Effects of Aging and Glycemic Control on Blood Products

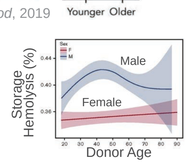
Aging

Platelet Hyperreactivity



Davizon-Castillo *et al.*, *Blood*, 2019

Increased Storage Hemolysis



Adapted from Kanias *et al.*, *Blood*, 2017

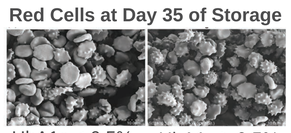
Poor Glycemic Control

Platelet Hypersensitivity

Hypofibrinolysis

Li *et al.*, *Journal of Clinical Medicine*, 2021

Red Cells at Day 35 of Storage



Adapted from Li *et al.*, *Transfusion*, 2022

There is a need to assess the impact of these factors in the CBS donor population.

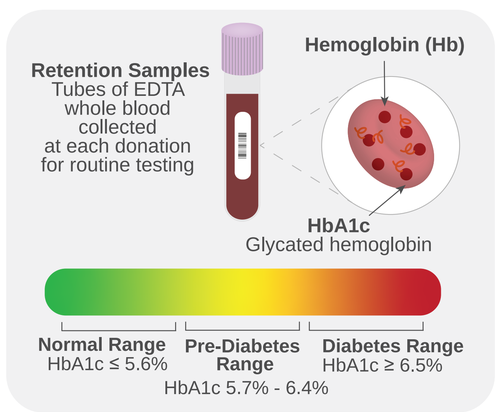
Project Goals

1. Screen glycemic control in CBS donors and investigate its relationship with markers of product quality
2. Characterize blood products from diabetic donors and donors across the eligible age range to investigate differences in quality and storage performance

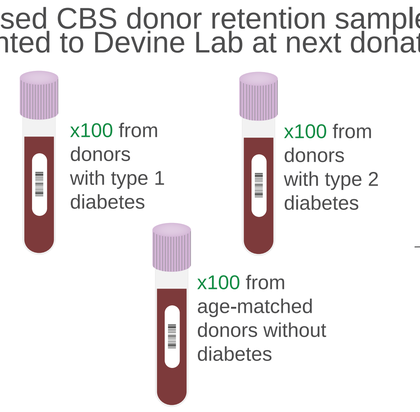
Proposed Study Design

= need for feasibility data

1

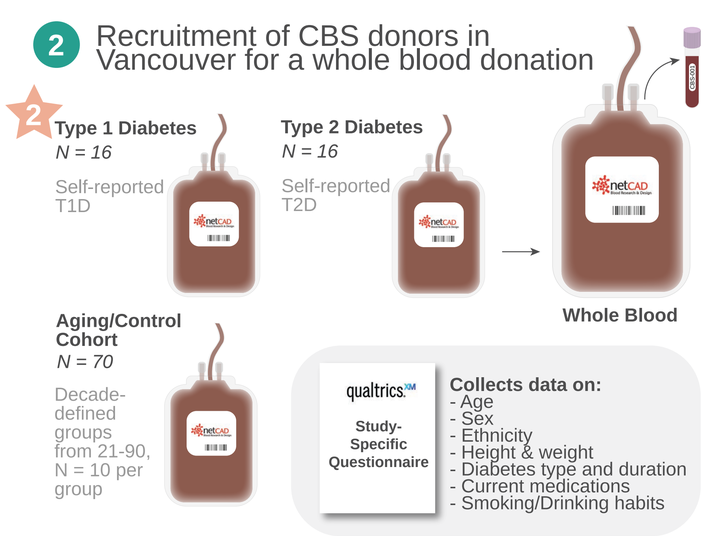


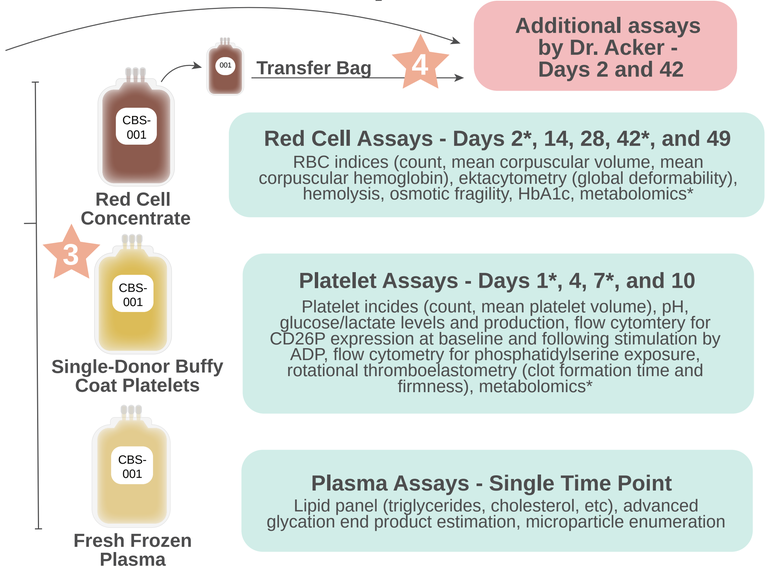
Unused CBS donor retention samples shunted to Devine Lab at next donation



- HbA1c Measurement
- Hemolysis Screening
- 1 Platelet Activation Screening

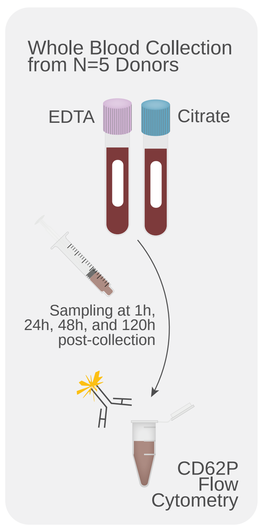
2 Recruitment of CBS donors in Vancouver for a whole blood donation





Feasibility Data

1 Will platelet activation in retention samples (stored up to 5 days) reflect baseline platelet activation?



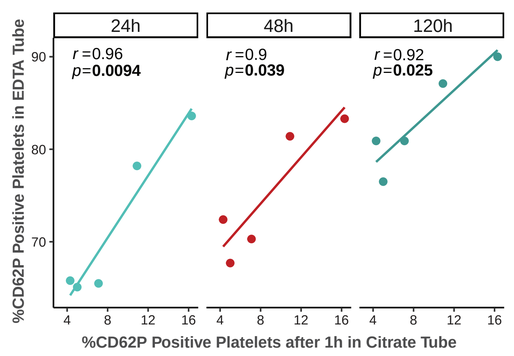


Figure 1. ***Correlations between baseline platelet activation and activation after storage in EDTA tube at 4ºC.*** Percentage of platelets displaying CD62P was assessed in the matched EDTA tube after 24h, 48h, and 120h post-collection - time points at which we may receive retention samples. Data was normally distributed and correlations were determined via Pearson's Correlation Coefficient.

Although platelet activation levels are higher in EDTA tubes, they correlate well with routine citrate measures at baseline for up to 5 days stored at 4C. This supports the feasibility of screening retention samples for platelet activation.

2 Are there enough donors with T1D in Vancouver for our study?

ePROGESA
CBS Donor Database

Diabetes? **Yes**
Date: **Mar 2021 - Mar 2022**
Donation Centre: **Vancouver**
Medications: **Insulin**

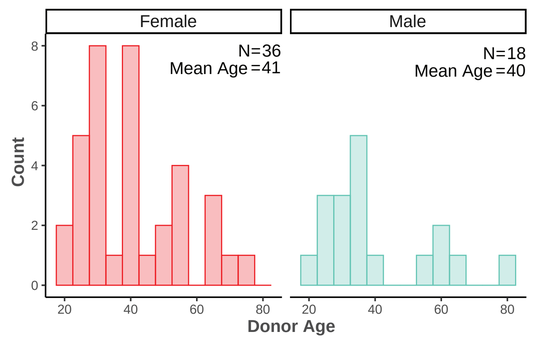
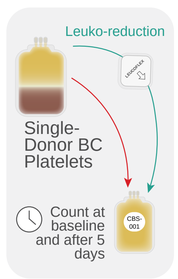


Figure 2. ***Canadian Blood Services donors with Type 1 Diabetes in Vancouver from March 2021-March 2022.*** CBS donor data was filtered and cleaned by Owen Miller.

A total of 54 CBS donors in the Vancouver area over the past year have type 1 diabetes. With these numbers, we are confident in our ability to recruit N=8 from each sex into our study.

3 Can single-donor buffy coat platelet products be produced for storage studies?



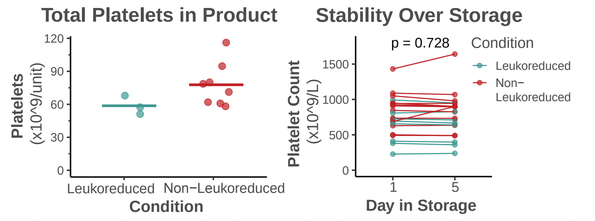
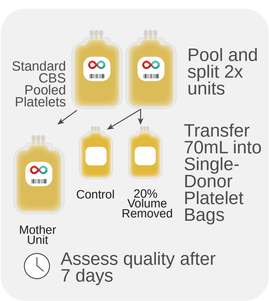


Figure 3. ***Characterization of single-donor buffy coat platelet products.*** Data generated by netCAD Blood4Reseach staff. Paired t-test used to evaluate stability over storage.



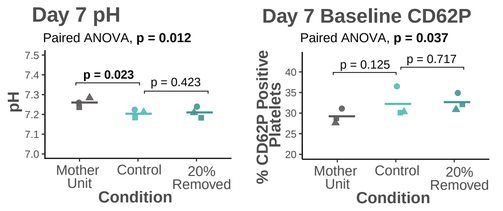


Figure 4. ***Comparing platelet storage performance in regular CBS bags, with single-donor platelet bags - accounting for volume removed for planned assays.*** Groups compared with paired ANOVA and pairwise t-tests. Shapes represent biological replicates.

A leukoreduced single-donor buffy coat platelet product with sufficent platelets for proposed experiments can be produced and stored. Smaller storage bags have comparable performance to regular platelet bags.

Next Steps

4. Validation of red cell concentrate storage in transfer bags for Dr. Acker's additional assays over the storage period
- Begin flagging donor records for the receipt of retention samples in Aim 1 - pending CBS ethics approval
- Begin donor recruitment for whole blood donation study - pending CBS ethics approval

Potential Impact

- **Significant donor characteristic-dependent differences**: Tailored storage times or applications of blood products based on donor characteristics
- **No donor characteristic-dependent differences**: Useful information for other blood services worldwide on the implications of expanding donor eligibility criteria

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