

Optimizing Collections Using a Prediction Algorithm

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Disclosures

The following faculty and planning committee staff have no financial disclosures:

Name	Institution
Dan Riddell, CLS, MT(ASCP)	Scripps Green Hospital
Angela Blackman, RN, BSN	Scripps Green Hospital
Joan Myers, RN, BSN	Carter BloodCare
Rachel Schuler, M.S.	NMDP/Be The Match
Kuchen Hale	NMDP/Be The Match

Learning objectives

Identify the impact of using a prediction algorithm for NMDP donors

Understand how you can modify your center's practices to include a prediction algorithm

Compare collection practices with other Network attendees

Benefits

- Customize collection to individual
- Ability to project expected cell yield
 - High peripheral pre CD34+ count = shorter collection
 - Opportunity to identify poor mobilizers
- Earlier pickup times for courier
- Prevent excessive overcollecting

11.3.1. Overview of PBSC mobilization

The procedures for mobilization and collection of PBSC products under this protocol may be based on the body weight of the proposed recipient, peripheral CD34+ cell count or to support other research protocols. The body weight is not adjusted for lean-body mass.

The following table provides recommendations for volume processed by weight of recipient. Volume processed refers to true whole blood volume, not including anticoagulant.

Table 3. Blood volume processed in relation to recipient weight.

Recipient Weight (kg)	Volume Processed (liters)	Procedure
≤ 35	12	Single 12-liter apheresis
36–45	15	Single 15-liter apheresis
46–55	18	Single 18-liter apheresis or two 12-liter procedures
56–65	22	Single 22-liter apheresis or two 12-liter procedures
> 65	24	Single 24-liter apheresis or two 12-liter procedures

Alternatively, centers may use an immediate pre-procedure blood CD34+ cell count to determine the blood volume to be processed. If such calculations are used, the negotiated CD34+ cell dose as specified in the final verification of PBSC request should be targeted as a minimum dose. If the negotiated CD34+ cell dose is collected in the first apheresis procedure, a second collection will not be performed.

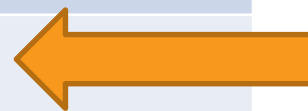
NMDP AC Network

- 80 domestic ACs surveyed in 2017
- 64% are using prediction algorithms



HPC(A) Collection Instruments

Instrument	% of centers
Spectra Optia	79%
Cobe Spectra	68%
Fenwal Amicus	13%
Other	4%



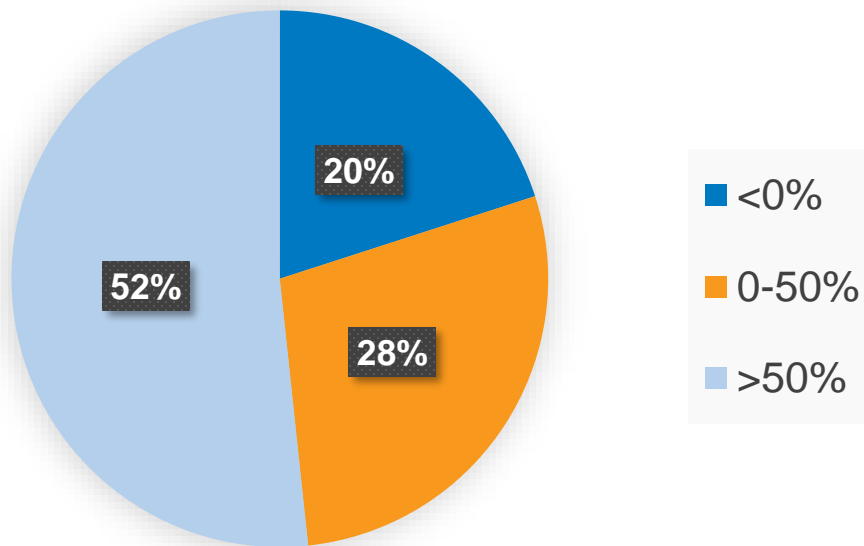
**69% will
switch to
Optia**

NMDP Data

- 859 U.S. collections
- CD34+ requested, CD34+ collected
- Calculated % difference in each request
- Defined 0-50% difference of requested CD34+ collected as desired range

NMDP Data

Collections - % difference



Range	Count (n=859)
<0% (under)	172
0-50%	243
>50% (over)	444

NMDP Data

<0%	n=172
Mean	-31%
Median	-28%

Example:

448 x 10⁶ requested
319.8 x 10⁶ collected

0-50%	n=243
Mean	27%
Median	28%

Example:

465 x 10⁶ requested
593.5 x 10⁶ collected

>50%	n=444
Mean	152%
Median	116%

Example:

370 x 10⁶ requested
800 x 10⁶ collected

Center Experience

Dan Riddell, CLS, MT(ASCP)

Angela Blackman, RN, BSN

Scripps Green Hospital – La
Jolla, CA



SUCCESSFUL USE OF A CUSTOM MADE PREDICTION ALGORITHM (PA) WITH THE SPECTRA OPTIA CMNC TO COLLECT FOR THE NATIONAL MARROW DONOR PROGRAM (NMDP)

- James R. Mason, MD, Daniel J. Riddell, CLS, MT(ASCP), Carol Burian, CCRP, Elisa Martinez, RN, Kathie Rector, RN
- Scripps Blood & Marrow Transplant Program, La Jolla, CA

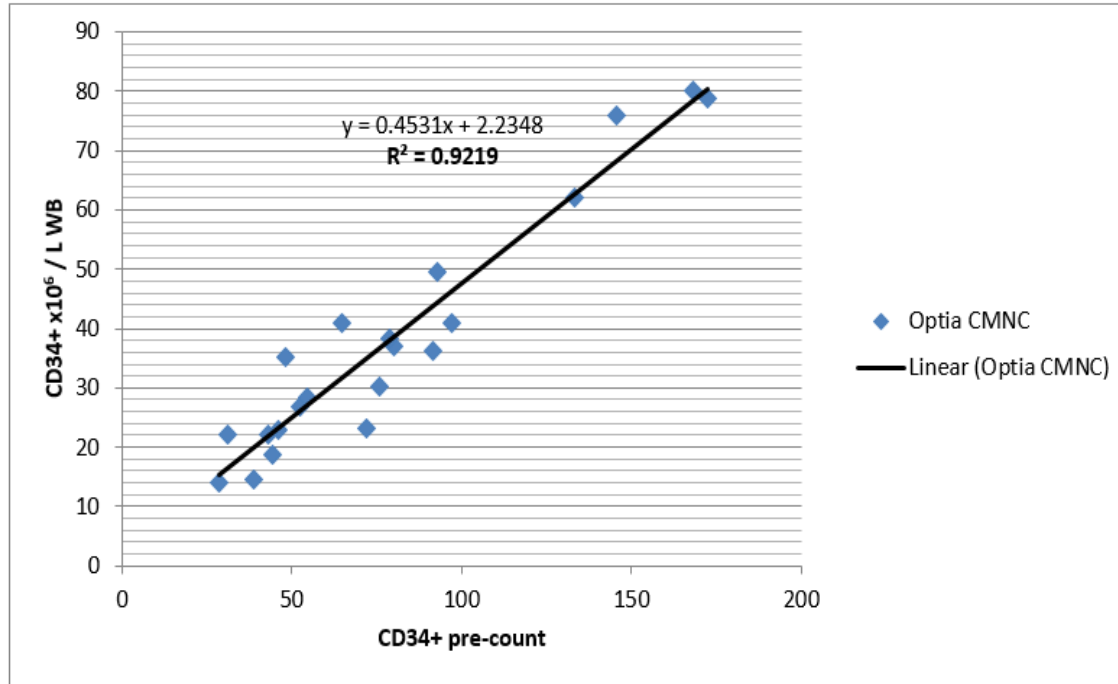
Purpose

Determine to what extent the use of a predictive algorithm (PA) with the new Spectra Optia CMNC could help improve ability to successfully collect CD34+ cell dose requested by NMDP and minimize donor platelet loss by processing less blood with shorter collection times.

Methods

- Data from 21 consecutive Optia NMDP collections performed from January to February, 2016
- Analyzed to create algorithm based on linear regression analysis between donor CD34+ pre-counts and corresponding CD34+ yields per liter of blood processed

A regression index of $R^2 = 0.9219$ was obtained, indicating a strong correlation between pre-collection CD34+ cell counts and normalized product cell yields.



③	⑤				
0.4531x + 2.2348					
Target CD34+/kg			Target total CD34+ x 10 ⁶ cells (GOAL)	505.0	②
Recipient weight (kg)			Donor CD34+ pre-count (cells/uL)	126.72	④
Donor CD34+ pre-count (cells/uL)		OR	Donor blood to process (L)	8.5	①
Donor blood to process (L)	0.0				
			Donor blood to process (mL) + 15% buffer	9,736	
			Volume processed before interface established (mL)	1,400	
			Total donor blood to process (mL)	11,136	

Volume of donor blood to process = $\frac{\text{Total CD34+ cells requested}}{(\text{Slope x Donor pre CD34+ cells}) + \text{intercept}}$

$$\textcircled{1} = \frac{\textcircled{2}}{(\textcircled{3} \times \textcircled{4}) + \textcircled{5}}$$

Methods (continued)

- 18 NMDP collections from April to May 2016
- Compared expected cell yields with actual collected as well as blood volumes processed and total collection times
- 15% cushion was added to process volume calculation to compensate for variability of collection process
- Simultaneously evaluated performance of Optia

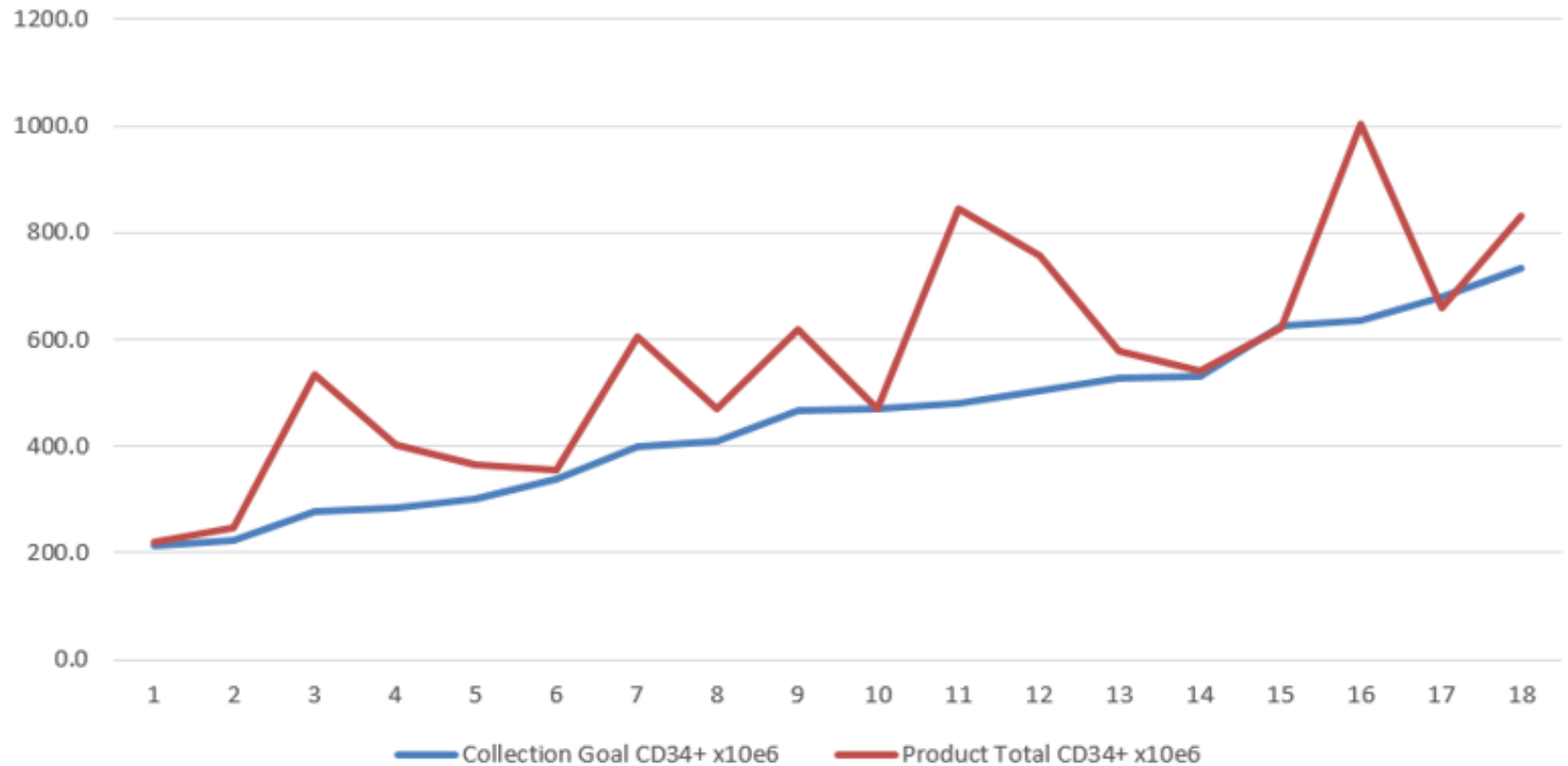
Results

- 17 of 18 collections met or exceeded CD34+ goals; the one below 100% (96.7%) was nevertheless considered acceptable
- Cell yields actually collected had a median of 114.1% (range 96.7 - 193.9) of CD34+ goal
- In some of the procedures where the actual yield significantly exceeded the goal, more blood than predicted by the algorithm had been processed (due to variability in whether the peripheral blood CD34 count was available before apheresis began)
- We processed a median of 11.96 L of whole blood (range 5.35 - 32.60) in a median of 158.5 minutes (range 105 - 343)

Results, continued

- Median of 90% MNC (range 77 - 99)
- Median of 3.0% HCT (min. 1.3, max. 5.7)
- Median RBC content of 9.4 mL (range 4.9 - 18.1) in the product
- Median platelet loss per total body volume in the donors was 13.2% (range 9.3-26.5)
- Median Spectra Optia CMNC CD34+ Collection Efficiency (CE2%) was 53.5% (range 40.8 - 73.4)
- Only one of the 18 donors ended up with a platelet post-count below $80 \times 10^3/\mu\text{l}$

CD34 Collection Yields



Conclusion

The use of a statistically-based PA using the Optia helped successfully collect CD34+ cell doses by:

- Processing significantly less blood than the maximum allowed (24L)
- Improving donor safety by minimizing platelet loss
- Improving product turn-around times for product transport

2017 Collection Data

1/1/2017 - 10/10/2017

NMDP HPC(A) collections: 208 single day (high volume/high flow rate)

	Total CD34+ Cells (x10 ⁶) Requested	Total CD34+ Cells (x10 ⁶) Collected	% of Collection Goal Collected	% CE2
Mean	411.0	646.2	241%	56%
Median	376.0	552.2	141%	55%
Max	1440.0	1745.8	*12389%	≥ 100%
Min	10.0	188.4	75%	34%

*TC declined use of PA, requested 22,000 mL blood processed

19 of 208 HPC(A) products did not contain the total CD34+ cells requested by TC.

- PA correctly predicted 15 of 19 would not meet goal, i.e. algorithm calculated >24 L required to meet goal
- Donor did not mobilize sufficiently to collect total CD34+ cells requested/an excessive amount of total CD34+ cells requested (e.g., 1440.0×10^6 CD34+ cells requested)
- PA did not correctly predict 4 of 19 collections that did not meet goal, i.e. algorithm calculated that the goal would be met by processing <24 L

PA Outliers

Collection Goal CD34+ (x10 ⁶)	Collected CD34+ (x10 ⁶)	% of Goal Collected	Volume of blood processed (mL)	%CE2	Comment
451.0	361.0	80%	16,301	38%	*PA outlier-%CE2 < 42%, difficult collection
350.0	262.1	75%	17,001	34%	*PA outlier-%CE2 < 42%, difficult collection
590.0	513.8	87%	20,001	37%	*PA outlier-%CE2 < 42%, difficult collection
435.1	384.8	88%	17,001	41%	*PA outlier-%CE2 < 42%, difficult collection

*PA outliers defined as <90% of goal collected when PA predicted blood processing volume required is <24 L

Center Experience

Joan Myers, RN, BSN

Carter BloodCare, Dallas-Ft.
Worth, TX



Predictive Algorithms: Our Journey

Joan Myers, RN, BSN

Clinical Apheresis Cell Therapy Manager

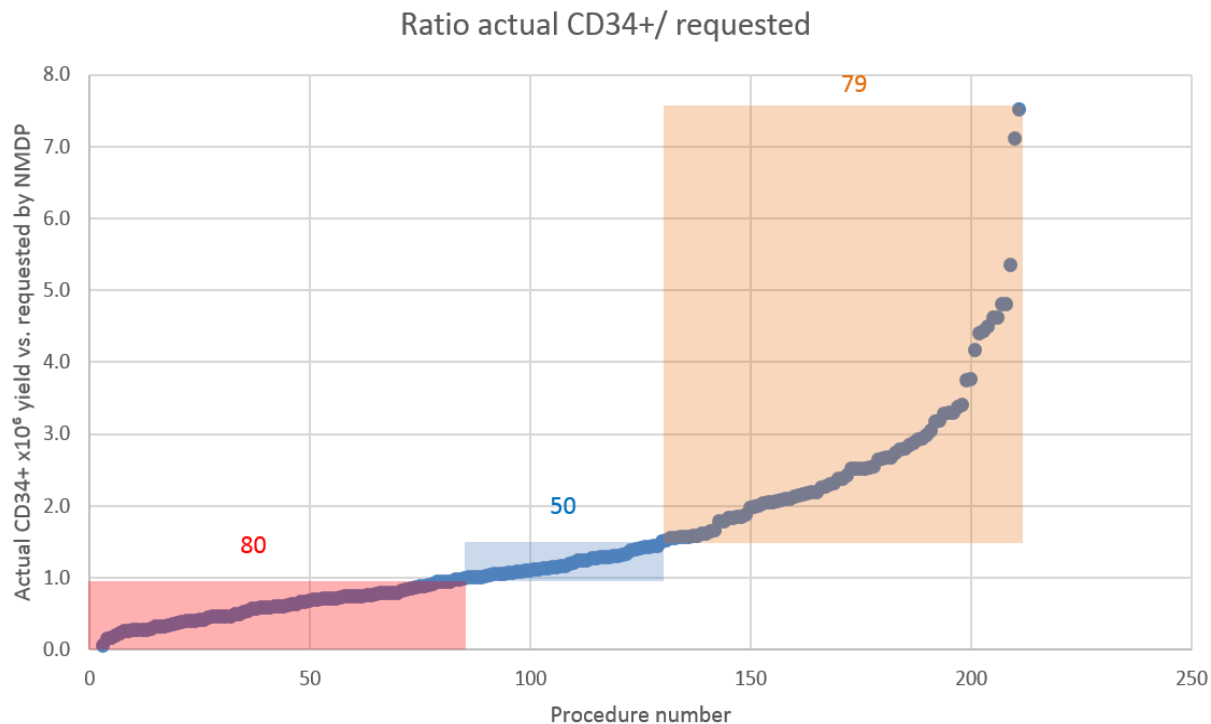
Carter BloodCare

Dallas, Texas

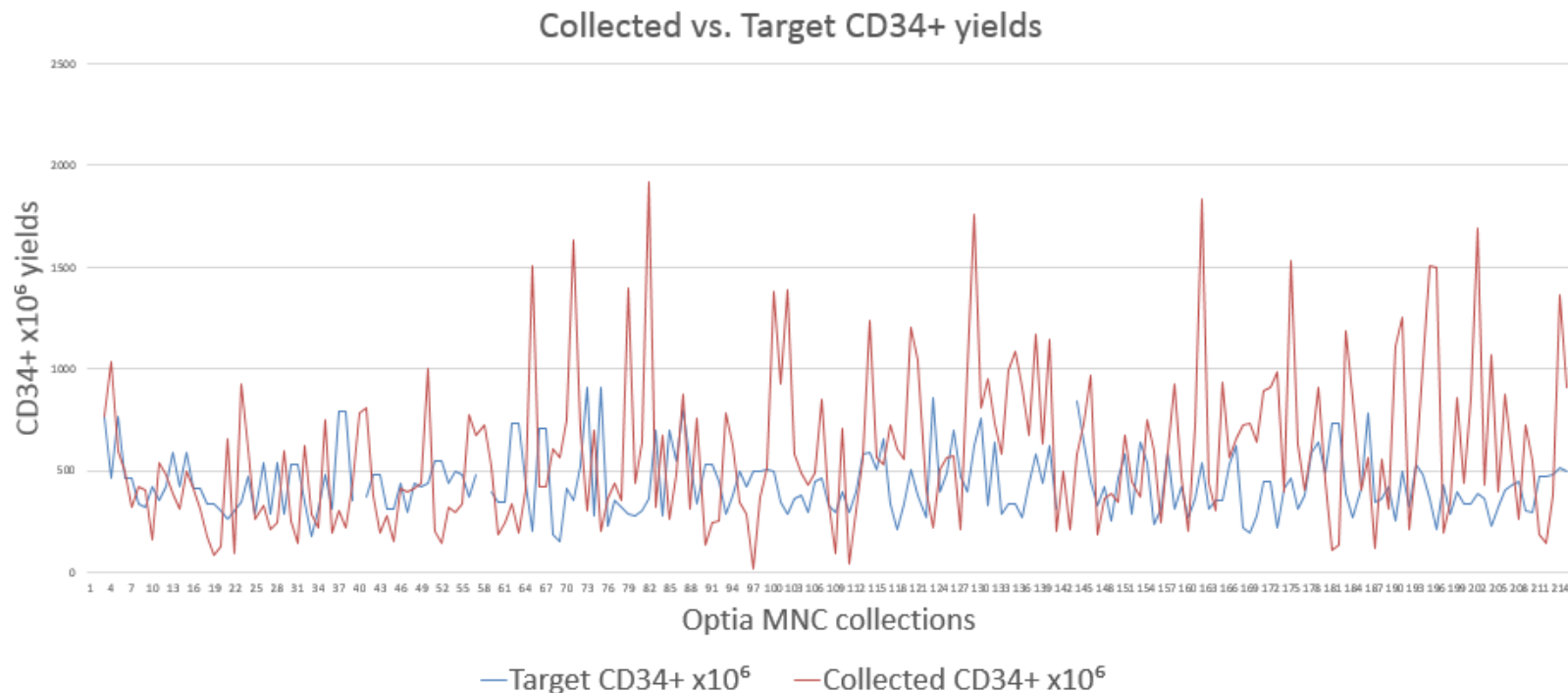
HISTORY

- NMDP network partner since 1999
- Two day collections (12L each day) primarily on COBE Spectra MNC
- Moved to one day collection in May 2016 processing 18 to 24 L
- July 2017 started using Predictive algorithms

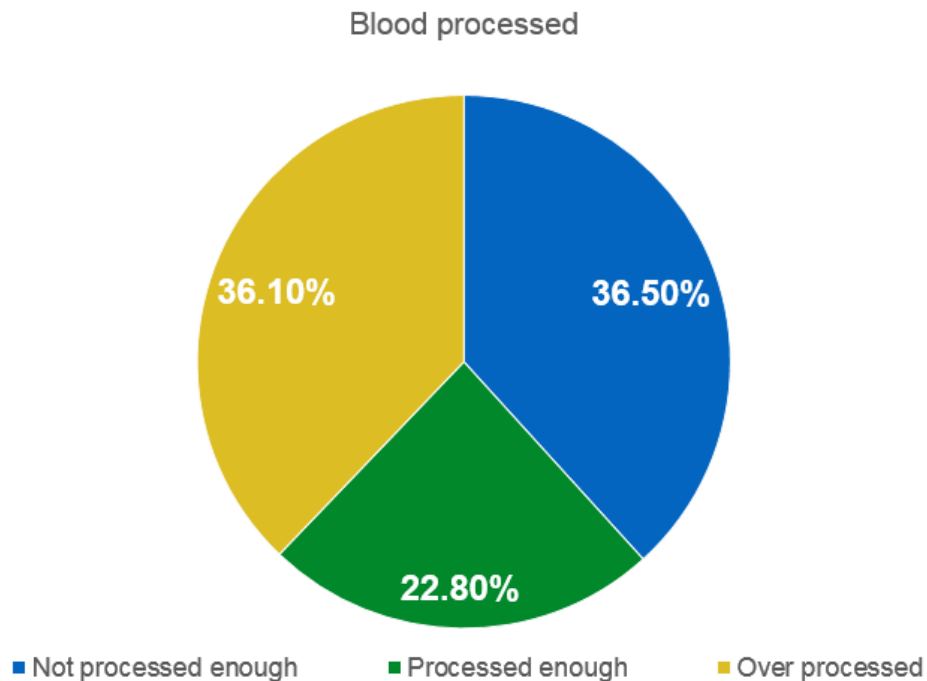
CD34+ YIELDS: ACTUAL COLLECTED VS. REQUESTED BY THE NMDP



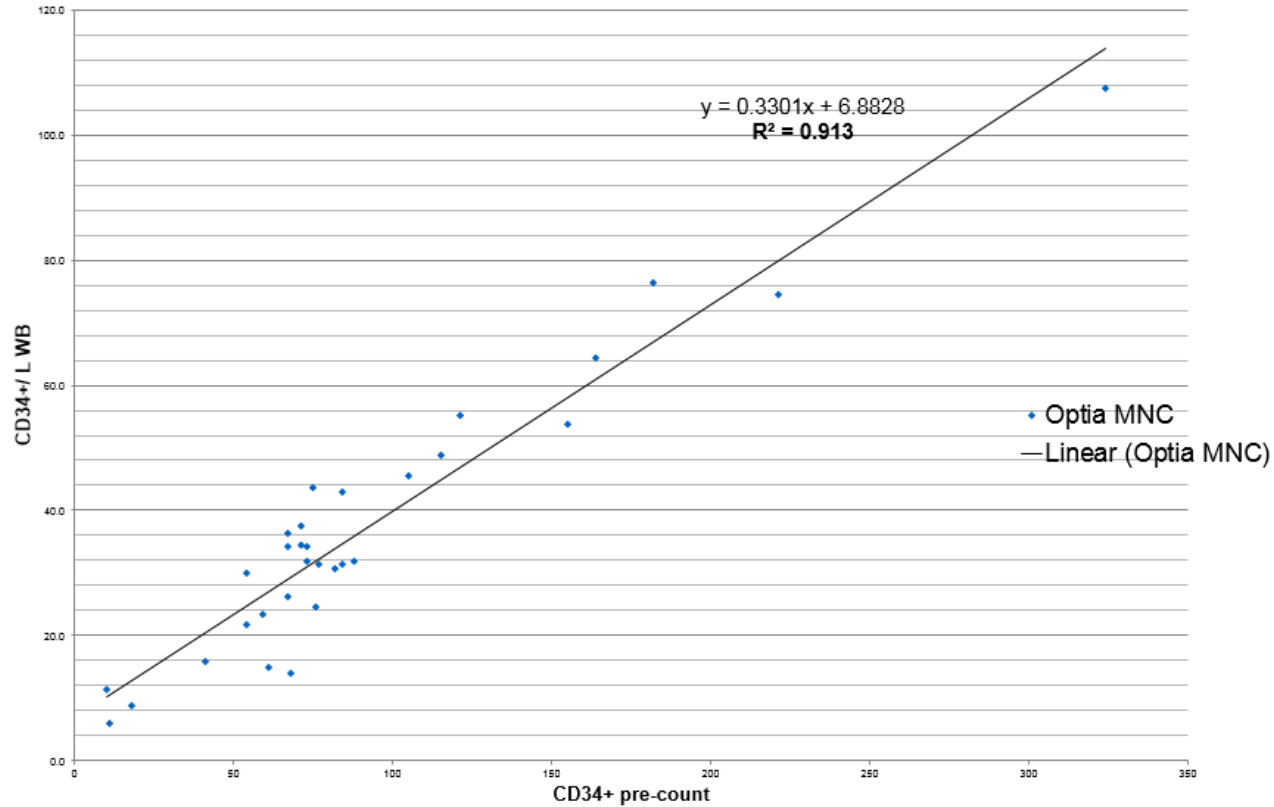
CD34+ YIELDS: ACTUAL VS. REQUESTED (2)



HOW FREQUENTLY DID WE UNDER- OR OVER-PROCESS BLOOD?



PREDICTABILITY FOR NMDP COLLECTIONS



CURRENT PREDICTION ALGORITHM

$$y = 0.4335 x + 0$$

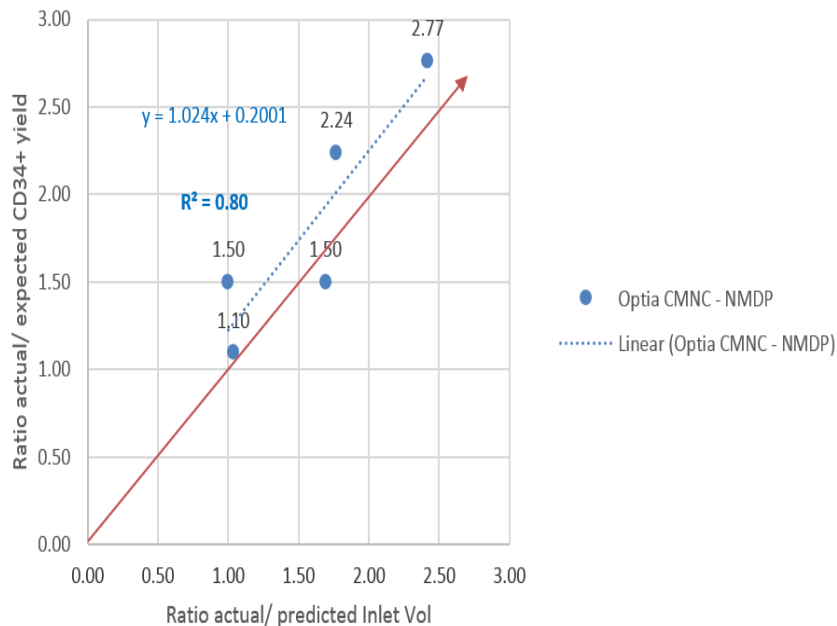
Target CD34+ x10 ⁶	437
CD34+ pre-count	50
Optia MNC WB liters to process	20.2

$$y = 0.4335 x + 0$$

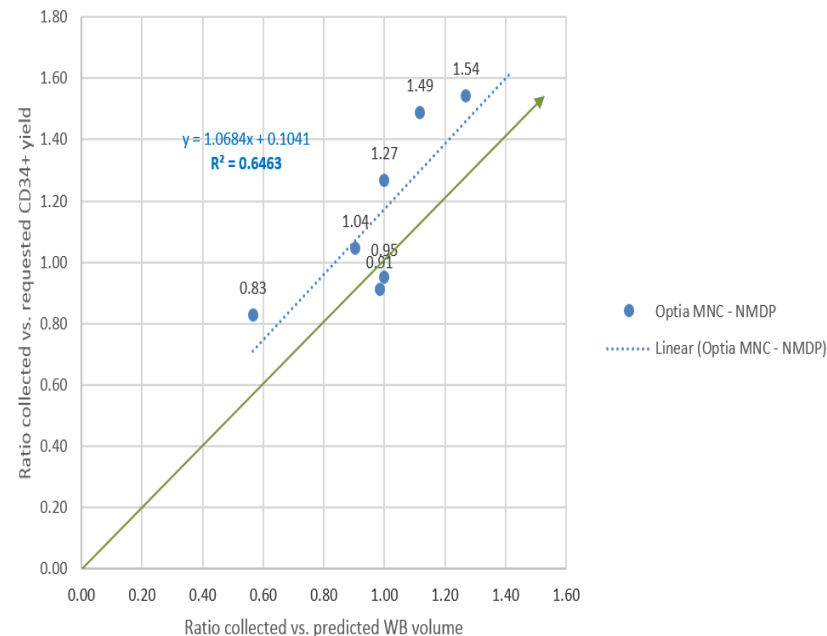
Target CD34+ x10 ⁶	437
CD34+ pre-count	120
Optia MNC WB liters to process	8.4

ACTUAL ALGORITHM PERFORMANCE – BOTH OPTIA PROTOCOLS

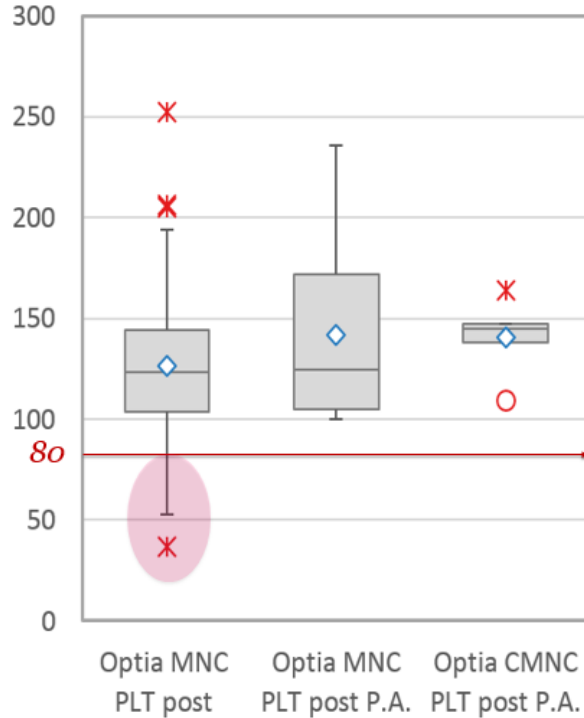
Optia CMNC - NMDP



Optia MNC - NMDP, no outliers

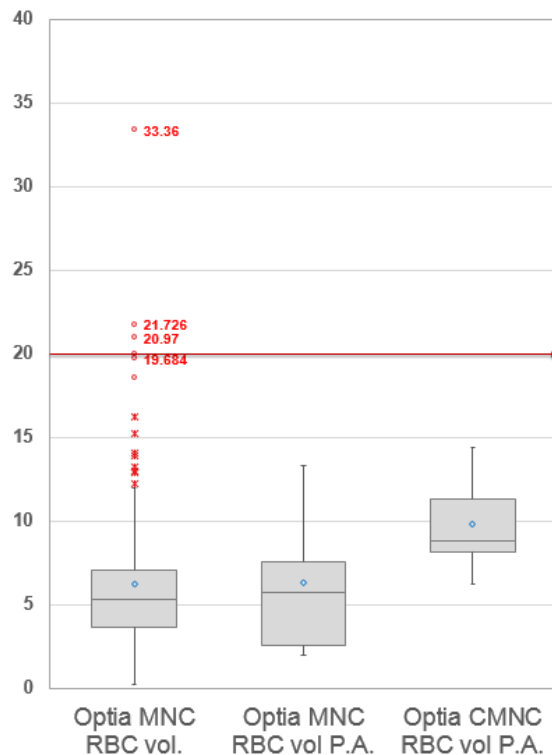


DONOR PLATELET POST-COUNT: BEFORE AND AFTER USING A P.A.



	Optia MNC PLT post	Optia MNC PLT post P.A.	Optia CMNC PLT post P.A.
Count	128	10	5
Min	37	100	109
1 Q	103.5	105	138
Median	123.5	124.5	145
3 Q	144	172	147
Max	252	236	164
Mean	126.5	141.8	140.6
StdDev	32.8	45.6	20.1

RBC IN PRODUCT: BEFORE AND AFTER USING A P.A.



	Optia MNC RBC vol.	Optia MNC RBC vol P.A.	Optia CMNC RBC vol P.A.
Count	213	11	5
Min	0.2	2.0	6.2
1 Q	3.6	2.5	8.1
Median	5.3	5.7	8.8
3 Q	7.0	7.5	11.3
Max	33.4	13.3	14.4
Mean	6.2	6.3	9.8
StdDev	4.0	3.9	3.2



Special thank you to
Joseph Roig, Terumo BCT

Manufacturer Contacts

Terumo BCT

- Customer Support: (877) 339-4228 or angela.richardson@terumobct.com
- Prediction Algorithms: joseph.roig@terumobct.com

Fresenius Kabi

- Customer Support: (800) 937-5060

NMDP Collection-Related Questions

NMDP AC/CC Liaisons:

AC-CCLiaisons@nmdp.org

Q&A



Evaluation Reminder

Please complete the Council Meeting 2017 evaluation in order to receive continuing education credits and to provide suggestions for future topics.

We appreciate your feedback!