Optimizing Blood Inventory in Northern Alberta

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Objectives

To optimize target red blood cell (RBC) inventory for 30 rural hospitals in Northern Alberta, in order to meet patient transfusion needs safely and use blood products efficiently.

Introduction

The basic goal of blood inventory management is to balance two conflicting objectives; satisfy demand while reducing wastage. Unsatisfied demand can lead to delay of surgeries or suboptimal treatment for emergency cases leading to increased risk of fatality.

Unfortunately, maintaining high volumes of stock to meet demand will also increase the chance of time expiry for blood units which waste fiscal resources as well as the limited blood resource.

Although a redistribution system has been implemented in Northern Alberta, transferring units still uses fiscal and staff resources and increases the amount of handling each blood unit experiences. Therefore, Northern Alberta hospitals still face a predicament in supplying their transfusion labs with enough blood units to save lives in an emergency while at the same time trying to reduce the wastage and redistribution rates.

Methods

Baseline Inventory

An inventory calculator was used to obtain estimates of optimum stock levels based on the annual number of transfusions at each site.

Figure 1. Inventory Calculator demonstrating an example of a hospital with 200 annual transfusions and the resulting suggested stock levels.

Hospital Name			<Enter Hospital>					
# of units RBC transfused annually			200	-Please enter the number of red cell units transfused in most recent year				
# days per year			250	-Based on average use per day				
Average daily red cell demand (ADRD)			1	-Calculates automatically				
By ABO / Rh					Approx # red cells used per day			
	O Pos	O Neg	A Pos	A Neg	B Pos	B Neg	AB Pos	AB Neg
% in pop [1.]	37.2%	8.0%	33.0%	6.8%	9.1%	1.8%	3.4%	0.7%
1 day stock	0.30	0.06	0.26	0.05	0.07	0.01	0.03	0.01
2 day stock	0.60	0.13	0.53	0.11	0.15	0.03	0.05	0.01
5 day stock	1.49	0.32	1.32	0.27	0.36	0.07	0.14	0.03
8 day stock	2.38	0.51	2.11	0.44	0.58	0.12	0.22	0.04
Suggested Maximum and Minimum Stock Levels (enter manually - not calculated):								
Max								
Min								

The denominator of 250 was used as number of days per year to account for hospital transfusions primarily occurring over weekdays.

The calculator provides blood group estimates based on the current Caucasian probabilities. The decimal values were counted as a whole unit for digits ≥ 0.5.

Revised Inventory

Inventory levels were then reviewed according to quality indicators:

- distance from the blood supplier
- type of clinical programs offered
- turn-around time for routine and STAT orders
- discard and redistribution rates

Results

Among the sites a range of 0-103 RBC units comprised the stock. Excluding Grande Prairie, the mean number of units held was 5 units.

Overall, the inventory calculator underestimated both the current and revised inventory levels, as the estimates were lower than the recommended minimum for providing emergency care.

However, it also highlighted 6 sites which should carry stock but currently do not such as the example below.

Figure 2. Comparing Beaverlodge current stock levels to the suggested stock levels from the inventory calculator.

Current Stock

Beaverlodge	O+	A+	B+	AB+	O-	A-	B-	AB-
Stock	0	0	0	0	0	0	0	0

Inventory Calculator Results:

Beaverlodge	O+	A+	B+	AB+	O-	A-	B-	AB-
5 day stock	1.15	1.02	0.28	0.1	0.25	0.21	0.06	0.02
8 day stock	1.83	1.63	0.45	0.17	0.39	0.34	0.09	0.03

Follow-up analysis showed a positive correlation ($p < 0.01$) between increased blood use and the ability to perform on-site testing as well as provide the following clinical programs:

- Obstetrical services
- Surgical services
- Medical services
- Endoscopy services

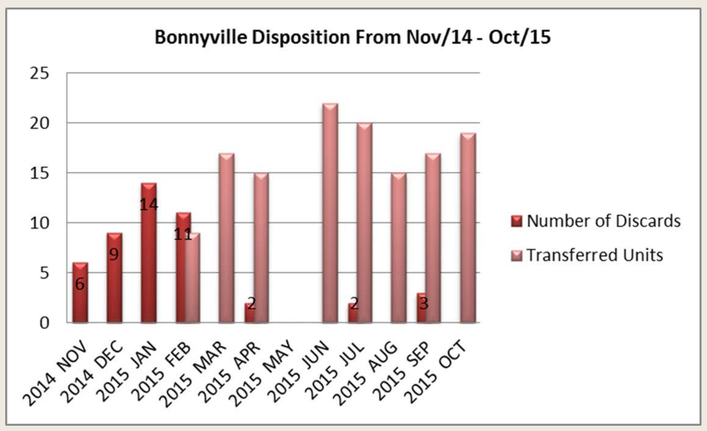
Accordingly, the revised inventory recommended for both increases and decreases from current stock depending on the hospital dynamics. In total, adjustments were advised for 73% of the hospitals reviewed.

The discard rate was *not* found to be correlated with the distance from the blood supplier.

The average discard rate was 4.6% and the average redistribution rate was 14.8%.

A redistribution system implemented in March 2015 for some sites resulted in a decrease in the discard rate as shown for Bonnyville below.

Figure 3. Effect of redistribution system in Mar 2015 on number of discards and transferred units for Bonnyville.



Conclusions

Determining target inventory levels through a systematic approach revealed areas in need of adjustment for the current stock levels.

An inventory calculator can be useful as a starting point for baseline inventory, as it can highlight where current stock is insufficient for a hospitals transfusion demands.

Quality indicators such as types of clinical programs offered were shown to impact the amount of blood use for each site, indicating that these factors should be reviewed when determining optimal inventory levels.

However, distance from the blood supplier did not impact the discard rate as was expected. Therefore, additional factors may need to be considered when aiming to reduce discard or redistribution rates.

Future Directions

An additional finding from this study was that the turnaround time for both routine and STAT orders had large variability between sites.

Some sites had turnaround times of 48 hours which may lead to overstocking practices and consequently higher discard or redistribution rates.

The variability in turnaround times was not related to distance from the blood supplier, as demonstrated in the figure below.

Figure 4. Distance from blood supplier versus the turnaround times for STAT orders.

Site	Distance from Blood Supplier	Turnaround time for STAT order
Peace River	196 km	3 hours
High Prairie	200 km	6 hours

Therefore, future research to further optimize inventory management should investigate the courier systems for transporting blood products in an effort to reduce turnaround times.

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Canadian Blood Services
it's in you to give

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