Hospital Highlight: A Novel Red Cell Inventory Ordering Algorithm

Hospital transfusion services maintain an on-site inventory of red blood cells to meet the immediate needs of patients, and to ensure product is available to meet sudden unexpected patient demand.

An important step to effectively manage on-site inventory for red blood cells is to determine an inventory threshold. These thresholds are often based on manually performed calculations that consider historical demand patterns, which must be updated on a regular basis as demand trends change. In determining an inventory threshold, hospitals must also consider minimizing the number of red blood cells units that outdate, and reducing the number of ad hoc orders and deliveries from Canadian Blood Services.

Another factor that may influence the number of units held in the transfusion service may be technologist and medical director comfort levels. Many transfusion service technologists will recall a “bad bleeder” story, and memories of these experiences can impact how inventory thresholds are determined.

Recognizing these challenges, Dr. Calvino Cheng, the Blood Transfusion Service and Pathology Informatics Group at Nova Scotia Health Authority Central Zone designed and implemented an innovative red blood cell inventory ordering algorithm.

“The objective was to introduce a real-time, semi-automated quantitative ordering system for red blood cells based on current usage data”, says Dr. Cheng.

Twice a day, a query is automatically run and a report is generated for transfusion service technologists indicating the amount of red blood cells that should be ordered from Canadian Blood Services. The factors used to determine the red blood cell order include current inventory, historical inventory data, system-wide patient hematology values and blood groups.

Basically, a rolling average demand is calculated and compared with current inventory levels. If the current inventory level is less than demand, then more red blood cells are ordered. If the current inventory level is more than demand, then red blood cells are not ordered.

The system has built-in fail safes to account for unpredictable events and to allow for flexibility. For example, an “anemia index” is built into the algorithm. The system scans the institution’s laboratory
information database for hematology values, blood groups, and determines potential demand based on those variables.

Dr. Cheng and his team reported that since the introduction of the algorithm on June 1, 2015, there has been compliance of the inventory thresholds, achievement of approximately a 20% average inventory reduction, and reduction of annual overall outdate rates of 0.7% vs 1.6% (Table 1). Specifically, group O and A outdates have reduced to approximately 1/8 of their previous rate during this period. Also, there have been time savings of at least 30 minutes per workday in determining inventory orders.

Table 1: CBS Hospital Disposition data for the 12 month pre vs 12 month post implementation

<table>
<thead>
<tr>
<th>Time Frame</th>
<th># RBC Transfused</th>
<th>#RBC Outdated</th>
<th>Group O &amp; A Outdates</th>
<th>Group B &amp; AB Outdates</th>
<th>Ave RBC Outdated / month</th>
<th>12 month Outdate Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 2014 to May 2015</td>
<td>14238</td>
<td>228</td>
<td>63</td>
<td>165</td>
<td>19</td>
<td>1.6%</td>
</tr>
<tr>
<td>June 2015 to May 2016</td>
<td>14904</td>
<td>98</td>
<td>8</td>
<td>90</td>
<td>8</td>
<td>0.7%</td>
</tr>
</tbody>
</table>

To read more articles, please visit the BloodNotes section of blood.ca