Recommendations for Effective Blood Supply Management

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Blood Stocks Management Scheme
London
Supply may not meet demand

Effective blood inventory management can help to meet the shortfall
Welcome to BSMS
The Blood Stocks Management Scheme was established in 2001 to understand and improve blood inventory management across the blood supply chain. Hospitals and Blood Centres from England, Wales, and Northern Ireland are currently participating in the scheme.

Central to our work is VANESA, a data management system, where hospital and blood service data is collected. In return participants can view real time data and charts.

What's New?
BSMS Newswire 21 Available
Newswire 21 is available to view and download within the publications section of the website.

Fate of Donation Project
The FOD project was closed on July 31. An end of project closure paper and report have been posted as PDF documents within the FOD section.

Visit: Fate of Donation Section

Latest Publications
16 April 2007
The aim of the 2006 survey ...

IPS 2006: Stock Control & Training

Training Courses
<table>
<thead>
<tr>
<th>Title</th>
<th>Location</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>VANESA 4</td>
<td>NBS Colindale</td>
<td>24/1/07</td>
</tr>
<tr>
<td>DUMMIES</td>
<td>NBS Colindale</td>
<td>31/1/07</td>
</tr>
<tr>
<td>VANESA 4</td>
<td>NBS Colindale</td>
<td>08/1/07</td>
</tr>
<tr>
<td>VIP's</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

BSMS Open Meeting 2007
Another successful BSMS Open Meeting was held on 10th May in Birmingham. A big thank you to everybody who came along and made it such a success.

Visit: Open Meeting 2007
The Blood Stocks Management Scheme collects data from Blood Services and Hospitals and gives feedback with the aim of increasing knowledge of blood inventory management.
Recommendations for Effective Blood Inventory Management
Relationship between Blood Centre Inventory Level and Wastage

- As the blood service inventory level increases the amount of time expiry wastage increases
- This is particularly apparent when the blood service inventory is significantly higher than the normal range.

**Graph:**
- Y-axis: Wastage as a percentage of issue
- X-axis: Issuable Stock Index (days worth of stock)
WHY?
Most units will be crossmatched multiple times during their life (the stock/reserve cycle).
Time Expiry Wastage

- The number of times a unit can be crossmatched before it expires is determined by the age of the unit at time of issue.
- When the blood service inventory is high, the age of units at issue declines.
- Time expiry wastage is therefore implicitly linked to blood service inventory.
Methodology

- 68 months worth of BSMS data were used for detailed analysis
- Variables were constructed and analysed by standard statistical techniques available in Excel, STATA and SPlus
Constructed Variables

- Two variables were constructed for blood service inventory
  - \texttt{STOCK} = \textit{Mean daily inventory}
  - \texttt{ISI} = \textit{Mean daily issuable stock index}
    \hspace{1cm} (The ISI is equivalent to the number of days worth of stock)

- Two variables were constructed for hospital time expiry wastage (TIMEX)
  - \texttt{TOTT} = \textit{Total monthly TIMEX}
  - \texttt{TAPI} = \textit{TIMEX as a \% of issue}
<table>
<thead>
<tr>
<th>Variable</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTT</td>
<td>823</td>
<td>8,457</td>
<td>2,864</td>
</tr>
<tr>
<td>TAPI</td>
<td>0.8%</td>
<td>5.8%</td>
<td>2.1%</td>
</tr>
<tr>
<td>STOCK</td>
<td>27,622</td>
<td>71,857</td>
<td>50,942</td>
</tr>
<tr>
<td>ISI</td>
<td>4.7</td>
<td>13</td>
<td>9</td>
</tr>
</tbody>
</table>

TOTT – Total monthly TIMEX
TAPI – TIMEX as a % of Issue
STOCK – Mean daily inventory
ISI – Mean Daily Issuable Stock Index
The Final Model

\[ TAPI = a(ISI_{t-1}) + b(ISI_{t-1} - ISI_{t-2}) \]

Where

\[ ISI_{t-1} = \text{ISI from previous month} \]
\[ ISI_{t-2} = \text{ISI from two months previous} \]

The model explains 80% of the variation in TIMEX
Features affecting Time Expiry Wastage

• The current inventory
• The change in inventory from the previous month.

The influence is split approximately equally across both features.
Recommendation for Blood Services

- Maintaining a stable inventory is as important as increasing the available age of units.
- A stable blood inventory allows hospitals to implement procedures to accommodate any older units.
Summary

- **Stable inventory**
  - Associated with Lower TIMEX

- **Variable inventory**
  - Associated with Higher TIMEX

Graph showing the days worth of stock from April to April, with peaks and troughs indicating the inventory levels.
Hospitals

- BSMS data and results from its 2006 Inventory Practice Survey were used to analyse factors influencing best practice in blood inventory management.
- The survey included questions on:
  - Stock control
  - Blood ordering
  - Stock sharing
  - Blood Conservation
Methods

• The survey results were used in conjunction with BSMS data from participating hospitals.
• BSMS data used:
  ➢ ISI (day’s worth of stock)
    The average ISI for each hospital during 2006 was calculated.
  ➢ WAPI (Wastage as a % of Issue)
    The average WAPI for each hospital during 2006 was calculated.
• Each survey question was analysed using statistical methods and null hypothesis.
Statistical tests

• The student t-test was used with the following assumptions: -
  - Data were normally distributed
  - Each hospital data set are independent of each other
  - Equal variance in data distribution

• The significance level was obtained using the p value (<0.05 value suggested the two samples were significantly different)
ISI & WAPI in Survey Hospitals

263 hospitals responded to the survey

<table>
<thead>
<tr>
<th>Statistics</th>
<th>Issuable stock Index (in days)</th>
<th>Wastage as a percentage of Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>2.99</td>
<td>0.42%</td>
</tr>
<tr>
<td>Maximum</td>
<td>13.68</td>
<td>16.49%</td>
</tr>
<tr>
<td>Mean</td>
<td>6.88</td>
<td>4.17%</td>
</tr>
<tr>
<td>Median</td>
<td>6.67</td>
<td>3.78%</td>
</tr>
</tbody>
</table>
Crossmatch Reservation period – 24 hours or 48 hours?

• Null hypothesis- There is no difference in ISI or WAPI between hospitals that have a 24 hour reservation period (n=79) and 48 hour reservation period (n=178).
Crossmatch Reservation period – 24 hours or 48 hours?

<table>
<thead>
<tr>
<th>Measure</th>
<th>Mean difference</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISI</td>
<td>1.01 days higher in 48 hours</td>
<td>0.02</td>
</tr>
<tr>
<td>WAPI</td>
<td>1.32 % higher in 48 hours</td>
<td>0.04</td>
</tr>
</tbody>
</table>

Both p values are < 0.05
Mean difference in ISI and WAPI for hospitals that have a 24 hour reservation period is significantly lower compared to hospitals with a 48 hour reservation period
Method of calculating quantity of blood for blood ordering

- Null hypothesis - there is no difference in mean ISI and mean WAPI between hospitals that use computer calculation and those that use visual review
### Method of calculating quantity of blood for blood ordering

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Sample Size</th>
<th>Mean Difference</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISI</td>
<td>Calculations n=68 Visual Review n= 34</td>
<td>-1.7 days</td>
<td>0.02</td>
</tr>
<tr>
<td>WAPI</td>
<td>Calculations n=68 Visual Review n= 34</td>
<td>-3.72%</td>
<td>p&lt;0.001</td>
</tr>
</tbody>
</table>

P< 0.05 for both ISI and WAPI. Mean ISI and WAPI was significantly lower for hospitals that used computer calculation for blood ordering compared to hospitals that used visual review.
Blood Transfusion session in the Medical Induction

• Null hypothesis- there is no difference in ISI between hospitals that had a blood transfusion session in the medical induction programme and those that did not.
### Blood Transfusion session in the Medical Induction

<table>
<thead>
<tr>
<th>Measure</th>
<th>Sample Size</th>
<th>Mean Difference</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISI</td>
<td>Session present= 217</td>
<td>-1.86</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>No session=37</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

P value is < 0.05
Hospitals that had a blood transfusion session in the medical induction programme had a significantly lower ISI compared with those that do not.
Does the Use of Cell Salvage Make a Difference in ISI?

- Null Hypothesis- there is no significant difference in mean ISI between hospitals that use cell salvage (post-operative and intra-operative) and those hospitals that do not.
Does the Use of Cell Salvage Make a Difference in ISI?

<table>
<thead>
<tr>
<th>Measure</th>
<th>Sample Size</th>
<th>Mean Difference</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISI</td>
<td>Both types= 88</td>
<td>0.98 days</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>No Cell Salvage= 35</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

P value is < 0.05. ISI is significantly lower in hospitals that use both types of cell salvage compared with hospitals that do not use cell salvage.
Recommendations for Hospitals

- Use a 24 hour crossmatch reservation period
- Use computer calculation for assessing the blood order
- Use cell salvage (post op and intra operative) compared with no cell salvage
- Include blood transfusion in the medical induction programme
Acknowledgments

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