Challenges in RBC Blood Transfusion in an Academic Medical Center

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Objectives

- Provide background information
- Identify the problems
- Discuss the challenges and methodology
- Present the results
- Plans for the future
Background

- Red Blood Cell transfusions are associated with:
  - Increase in infection risk
  - Increase in mortality
  - Increase in morbidity
  - Increase Hospital length of stay
  - Increase Hospital costs
Background

- **What was the problem at UPHS?**
  - It was noted by clinicians and blood bank personnel that there was an opportunity to improve RBC utilization
  - There was a lack of consistency among clinicians when ordering red blood cells

- **Performance Based Incentive Programs**
  - CEQI- Clinical Effectiveness and Quality Improvement
    - Incentives to improve patient care

- **GOAL**
  - Demonstrate that the integration of technology with a Clinical Decision Support tool can facilitate adherence to Evidence Based Practice and enable measurability.
The Center summarizes scientific evidence for UPHS decision making about high impact drugs, devices and processes of care, and is charged with building evidence-based collaborative enterprises with external organizations.

- February 2009
  - CEP report done on “Indications for Transfusion of Blood Components” with the aim to develop these indications
  - An interdisciplinary group of clinicians from UPHS reviewed the results of the meta-analysis and indications were agreed upon and established
Plan

- To develop a decision support tool, founded on evidence-based practice, for clinicians to utilize when ordering blood products

  - Initial plan was to implement health system-wide but there were significant challenges encountered
    - Variations in technology and clinical practice in all entities
    - Time limitations

  - As a result, the tool was piloted at one hospital to allow for design changes based upon analyses of initial results
Primary Objectives

- Develop a clinical decision support tool through a blood transfusion order set in Sunrise Clinical Manager
- Pilot the use of the order set at Penn Presbyterian Medical Center
- Evaluate the effectiveness of the order set
- Develop a refined tool for use at Pennsylvania Hospital and then at the Hospital of the University of Pennsylvania
Clinical Decision Support-RBC  Version 1.0

Transfusion Set RBC - PMC [0 orders of 14 are selected]

Packed Red Blood Cell Transfusion
The following indications are appropriate for RBC transfusion. Randomized controlled trials have consistently demonstrated that inappropriately used RBC transfusion is associated with higher patient mortality.

<table>
<thead>
<tr>
<th>HEMOGLOBIN LEVEL</th>
<th>APPROPRIATE INDICATION FOR RBC TRANSFUSION</th>
<th>Priority</th>
<th>MD Receptor</th>
<th>Existing Condition?</th>
<th>Infusion Rate/Unit</th>
<th># of Units</th>
<th>Starting Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>LESS THAN 7.0 g/dL</td>
<td>Severe Anemia</td>
<td>(a)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BETWEEN 7.0 and 9.4 g/dL</td>
<td>Acute Coronary Ischemia</td>
<td>(b)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BETWEEN 7.0 and 9.4 g/dL</td>
<td>Anemia with chronic cardiopulmonary disease</td>
<td>(c)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BETWEEN 7.0 and 9.4 g/dL</td>
<td>Oncology/BMT with anticipated high risk</td>
<td>(d)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GREATER THAN 9.5 g/dL</td>
<td>Active bleeding with anticipated blood loss</td>
<td>(e)</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

ACETAMINOPHEN:
- acetaminophen - (500 mg tablets)
- acetaminophen suppository - (500 mg)

DIPHENHYDRAMINE:
- diphendehydrAINE tablet - (25 mg)
- diphendehydrAINE oral liquid - (12.5 mg/mL)
- diphendehydrAINE injection - (50 mg/mL)

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Lab Orders:
- CBC W/Diff [Hema Profile+Elect Diff]

Drug Info
Methods

- **Electronic order set was implemented at PPMC in April 2010**
  - Limited provider education
    - Tool was designed to be intuitive and included menu-driven transfusion indications with 3 ranges of hemoglobin levels (a lab value that has become one of the measuring points for a blood transfusion)

- **Data Validation**
  - Manual verification of the data pull with the EMR

- **Data Collection**
  - Pre and Post Intervention data was collected and analyzed with assistance from the Penn Data Store
Penn Data Store

Source Systems

Real-Time Interfaces/Data Query

MedView

WEB PORTAL AND ALERTS

Penn Data Store

INFORMATION

OBI “engine”

Dashboards and charts

“Answers”

Ad hoc query

Excel files

User supplied query tools

Patient

Encounter

Dx & Proc

Orders & Results

Inpatient Infection

Nightly Extract Process

Reg/Sched IP/OP

EMPI

Lab

Rad

IP EMR

OP EMR

TheraDoc

CV Surg STS

Press Ganey

HPM

GI

Cardio

Neuro

ED

Derm

OB/GYN

Pulmonary

Hem-Onc

Penn Medicine
RESULTS

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Total Patients</td>
<td>7661</td>
<td>7779</td>
</tr>
<tr>
<td>Total Patients with RBC Transfusion</td>
<td>790</td>
<td>671</td>
</tr>
<tr>
<td>Rate of RBC Transfusion</td>
<td>10.31%</td>
<td>8.62%</td>
</tr>
<tr>
<td>Average #Units per Patient Stay</td>
<td>2.71</td>
<td>2.68</td>
</tr>
<tr>
<td>Total Orders</td>
<td>2341</td>
<td>1855</td>
</tr>
</tbody>
</table>

- Rate of RBC transfusion decreased by 16.39% which was statistically significant (p<0.05); Total patients with RBC transfusion decreased by 15%

- Total Orders decreased by 21% (2341 to 1855)

- Average #units transfused per patient stay decreased by 1.11% but the difference is not statistically significant (p>0.05)
Results (continued)

- The design of the order set resulted in a reduction of the median hemoglobin level used for transfusion ordering

  Median Hg
  - Pre Intervention 7.7 g/dL
  - Post Intervention 7.6 g/dL
  - $p= 0.96$

- The decrease in median hemoglobin level from pre to post order set was not statistically significant
Conclusion/Future plans

- More education will be provided to ordering clinicians prior to the launch of the enhanced order set version 2

- Implementation of the order set at HUP
  - A unified order set is being discussed as opposed to 3 different versions for the 3 hospitals in the health system

- Similar process in place for utilization of other blood products i.e., Fresh Frozen Plasma and Platelets

- Use of an analyzer software to determine the appropriate type of blood products to use
  - Trial complete and to be implemented in the Operating Rooms
    - TEG System®
Conclusion/Future plans

- Implement a real time online Dashboard with drill down capabilities and graphical presentations of the data (in development)
“When evaluating a hemoglobin level, treating physicians must resist the temptation to “first do something” and temper this temptation with a philosophy of “first do no harm” to achieve the optimal balance of providing the best risk-benefit and cost effective outcomes of transfusion therapy for patients.”

– Shander, A. & Goodnough, L, 2010 JAMA