Reduction of Blood Transfusions and Hospital Expenses through Lean Six Sigma-Based Process Improvement

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The Case for Blood Stewardship

• Most frequent inpatient procedure in USA
  ➢ >10% of all hospital stays; 6 million patients/year
  ➢ rate doubled from 1997 to 2009

• Average RBC unit cost: $522 to $1,183
  ➢ 25% actual blood product cost; 75% labor activity cost

• SHOTS (Serious Hazards of Transfusion)
  ➢ Often unrecognized/unreported

• Evidence supports restrictive transfusion protocols
OVERALL USE OF BLOOD PRODUCTS ACROSS THE INPATIENT POPULATION

This graph highlights the selected facility's overall blood product utilization compared to all other QualityAdvisor™ hospitals included in the analysis. Median, Top and Bottom Quartile as well as Top and Bottom Decile comparatives are provided. Blood products are combined and include: cryoprecipitate, plasma, platelets, red blood cells and whole blood.
Blood Stewardship Business Case

- FY2012 Q1 (N=912 patients-84% inpatients; 2,382 total units transfused per quarter, 9,528 per year):
  - 83% of non-bleeding patients were transfused > AABB guideline
  - 51% of patients with surgical bleeding transfused > AABB guideline
  - Two unit transfusions ordered in 70% of patients, despite AABB one unit guideline
  - Post-transfusion hemoglobin (mean=10 g/dL) significantly higher than recommended minimum values

- A conservative 10% reduction in volume, at a conservative $800 per unit cost, results in net savings of $762,240 per year
Project Objectives

- Design modern evidence-based transfusion protocol
- Optimize computer-based blood ordering process
- Educate to evolve blood use culture
- Implement mechanism(s) for real time alert/intervention for off-guideline blood orders and ongoing control
Lean Six Sigma

HIGH PROCESS MATURITY

LOW PROCESS MATURITY

Value

Volume

Long Term
Continuous Improvement
System Focus
Service Focus
Product Focus
Short Term

COST
Low Cost/Waste
High Cost/Waste

QUALITY
Zero Defects
High Defects

SERVICE
High Customer Satisfaction
Low Customer Satisfaction
<table>
<thead>
<tr>
<th>Define</th>
<th>• What are the customer’s expectations of the process?</th>
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</thead>
<tbody>
<tr>
<td>Measure</td>
<td>• What is the frequency of defects or wastes in the process?</td>
</tr>
<tr>
<td>Analyze</td>
<td>• Why/when/where do defects or wastes occur?</td>
</tr>
<tr>
<td>Improve</td>
<td>• How can we fix the process (set of counter-measures)?</td>
</tr>
<tr>
<td>Control</td>
<td>• How can we maintain the gains?</td>
</tr>
</tbody>
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# The Project Team

<table>
<thead>
<tr>
<th><strong>Project Sponsor:</strong></th>
<th>Linda Jones, DNS, RN</th>
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<tbody>
<tr>
<td><strong>Project Leader:</strong></td>
<td>Charles Callahan, PhD, MBA</td>
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<tr>
<td><strong>Project Owner:</strong></td>
<td>Kim Cruise, MT (ASCP)</td>
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<tr>
<td><strong>Team Members:</strong></td>
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<tr>
<td>D. Adair, MD-<em>Orthopedics</em></td>
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<tr>
<td>E. Agamah, MD-<em>Oncology</em></td>
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<tr>
<td>A. Groesch, Pharm.D.-<em>Pharmacy</em></td>
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<tr>
<td>T. Gillison, MD-<em>Oncology</em></td>
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<tr>
<td>B. Marshall, MD-<em>Blood Bank</em></td>
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<tr>
<td>S. Nagendra, MD-<em>Lab/Pathology</em></td>
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<tr>
<td>R. Govindaiah, MD-<em>CMO</em></td>
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<tr>
<td>G. Suchomski, MD-<em>Family Medicine</em></td>
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<tr>
<td>C. Todd, MD-<em>Hospital Medicine</em></td>
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<tr>
<td>M. Weaver, MD-<em>Hospital Medicine</em></td>
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<tr>
<td>P. White, MD-<em>Pulmonary/Critical Care</em></td>
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<tr>
<td>K. Baur, RN-<em>Cardiology</em></td>
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<tr>
<td>J. Cawley, CCP, LP-<em>Perfusion</em></td>
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<tr>
<td>A. Murphy-<em>Informatics</em></td>
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<tr>
<td>A. Nickles-<em>Informatics</em></td>
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<tr>
<td>P. Sullivan, LSSBB-<em>Lab</em></td>
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<tr>
<td>T. Stade, MT (ACSP)-<em>Blood Bank</em></td>
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</table>
Transfuse - Red Blood Cells

Physician

Recent Patient Labs

<table>
<thead>
<tr>
<th>Patient Name</th>
<th>DOB</th>
<th>Age</th>
</tr>
</thead>
</table>

LAB RESULTS:
- Hct:
- Hgb:
- Svo2

Type and Screen:
- Blood Type:
- Antibody Screen:
- Crossmatch:

Expiration Date:

Active Bleeding Patient

- Yes
- No

Reason for Transfusion: Active Bleeding Reasons

- Gastro-intestinal source
- Genito-urinary source
- Upper-respiratory tract source
- Other:

Please Click the Green Check Mark in the Upper Left Hand Corner to Sign the Form after documentation is complete.
Reason for Transfusion: No Active Bleeding

- Hgb $\leq$ 7g/dL, AND signs or symptoms of anemia, OR pre-operative state.
- Preeexisting cardiovascular disease, AND signs or symptoms of anemia OR Hgb $\leq$ 8g/dL.
- Post-operative patients, with Hgb $\leq$ 8g/dL, AND/OR signs and symptoms of anemia
- Sepsis: Hgb $\leq$ 10 g/dL AND SCVO2 $\leq$ 70% per sepsis protocol.
- Hgb $\leq$ 9 g/dL in patients receiving chemotherapy OR radiation therapy.
- Sickle cell, myelodysplastic syndrome, hemolysis, OR other red cell disorder
- Acute coronary syndrome with Hgb $\leq$ 10 g/dL, AND signs or symptoms of anemia
- Other.

Instructions to Nursing

Transfusion Priority

- Today

Transfusion Date

- 12/18/2013

Duration - Transfuse Over (hrs)

- 2

Number of Units

- 1

Reason for Additional Units

Specialty Product Type

- None
- Irradiated
- CMV negative

Post-Transfusion Hgb

- Yes
- No

Consider repeat HGB if more than 1 unit is selected, if Yes is selected Nurse will receive Communication Order to Place HGB 2hrs post transfusion.
Requirements of Transfuse RBC Nursing Order

1. Reason for transfusion (see back for details)
2. If requesting more than one unit, suggest transfusing one unit and reassessing the patient’s Hgb and symptoms.
3. Does the physician want a post-transfusion Hgb drawn?

Reason for Transfusion

- Hgb ≤ 7g/dL, AND signs or symptoms of anemia, OR preoperative state.
- Preexisting cardiovascular disease, AND signs or symptoms of anemia OR Hgb ≤ 8g/dL
- Postoperative patients, with Hgb < 8g/dL, AND/OR signs and symptoms of anemia
- Sepsis: Hgb < 10g/dL AND SCVO2 < 70% per sepsis protocol
- Hgb < 9g/dL in patients receiving chemotherapy OR radiation therapy
- Sickle cell, myelodysplastic syndrome, hemolysis, OR other red cell disorder
- Acute coronary syndrome with Hgb < 10g/dL, AND signs or symptoms of anemia
- Other:
$2.8M annualized savings
(32% decrease - 934 to 635 units/month @$800/unit

RBC Units Transfused

Date/Time/Period

450.
500.
550.
600.
650.
700.
750.
800.
850.
900.
950.
1000.
1050.
1100.
1150.
1200.
1250.
1300.
1350.

UCL

CL

LCL

RBC Units Transfused

627.7
793.1
958.5
870.
660.

Jan-11
Mar-11
May-11
Jul-11
Sep-11
Nov-11
Jan-12
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
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Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
Jul-15
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43% Growth in Belts
27% Growth in Projects
Memorial Health System Lean Six Sigma Improvement Trend Program to Date (186 Projects)

Z Score

Yield

Pre-Project

Post-Project

42% Improvement

68.0%

3.30

1.97
Lessons Learned

• Lean Six Sigma process works in healthcare
• Physician engagement is key
• Project teams not “committees”
  ➢ Short term, focused, measurable outcomes
• Evidence versus Eminence
• Ongoing Control Plan
• Celebrate & accelerate dispersion of the learning yield
Selected References

Biographical Sketch

Charles D. Callahan, PhD, MBA, FACHE
Dr. Callahan earned his doctorate degree in Clinical Psychology at the University of Nebraska-Lincoln in 1991, and his MBA at the University of Illinois-Springfield in 2004. A Fellow of the American Psychological Association and the American College of Healthcare Executives, he is board certified in Rehabilitation Psychology by the American Board of Professional Psychology. Dr. Callahan has over 50 professional publications in the areas of brain injury rehabilitation, neuropsychology, emergency/trauma medicine, healthcare process improvement, and outcomes measurement. He previously served on the editorial boards of Rehabilitation Psychology and The Journal of Head Trauma Rehabilitation, and is a Past President of the American Psychological Association’s Division of Rehabilitation Psychology. Callahan previously served on the United Way of Central Illinois Board of Directors, including a term as Board Chair in 2012-2013. In 2014, he became founding Co-Executive Director of the Midwest Healthcare Quality Alliance, LLC. He has been employed by Memorial Health System, Springfield, Illinois, since 1991, and currently serves as its Executive Vice President and Chief Operating Officer.
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**Name:** Charles D. Callahan, MD

**Event Title:** IHF 39th World Hospital Congress

**Program Title:** Reduction of Blood Transfusions and Hospital Acutes Through a Lean Six Sigma Based Process Improvement

**Relationship:** ☑️ Free Paper Presenter

Do you or any immediate family member have a financial relationship or interest (currently or within the past 12 months) with a proprietary entity? ☐ Yes ☑️ No

If Yes, please identify the company and the nature of the financial relationships and compensation below.

<table>
<thead>
<tr>
<th>Self and/or Immediate Family Member</th>
<th>Commercial Interest</th>
<th>Type of Relationship</th>
<th>Nature of Compensation</th>
<th>Relevant to Presentation Content Yes/No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example: Self</td>
<td>Company M</td>
<td>Board of Directors</td>
<td>Honorarium</td>
<td>No</td>
</tr>
</tbody>
</table>

Do you intend to discuss an unapproved/investigative use of a commercial product/device? ☐ Yes ☑️ No

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Name: ___________________________ Date: 5/19/15

Please fax or email this document to Megan Angelini by June 22nd, 2015 at (312) 424-0023 or mangelini@ache.org