Achieving Patient Safety through Wireless Electronic Transfusion Verification System and Bar Code Scanning

Contributed by

University of Iowa Hospitals and Clinics
Iowa City, IA

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Learning Objectives

Upon completing this session, attendees will be able to:

- Describe how to engage individuals to participate in root cause analysis in a nonpunitive environment
- Describe the mechanisms by which bar code scanning enhances transfusion safety
- State the implementation challenges and future prospects for bar code scanning in blood transfusion
Bar Code Technology and Transfusion Safety:
Six Years of Experience Points Toward Future Software Standards

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The Major Points

- Bar code technology is mature/practical
- Its use is steadily increasing
- It can clearly be used to significantly increase transfusion safety at all key steps in the transfusion process
- Current HIS and LIS transfusion software products do not use its full potential
- Programming standards are needed

Transfusion Safety

- Transfusion is clearly a very complicated process with multiple steps and handoffs
- One widely quoted reference estimates that one mis-transfusion event occurs for every 12,000 units of RBCs that are transfused *
- The reduction of transfusion error is a Joint Commission patient safety goal
- Various forms of technology have been shown to reduce error – but there is no consensus yet about best practice

Status Of The Problem At UIHC Prior To 2005

- A two witness/two signature policy had been put in place after a sentinel event

- Mis-transfusions were being detected and reported to the FDA about every 2.5 years

- For UIHC this translated to one event detected per 43,000 units of RBCs transfused

- However, since mis-transfusions go undetected about 50% of the time, our rate was probably really one per 1.25 years and one per 21,500 units – and therefore only modestly better than the estimated national average (one per 12,000)

How Was The Problem Approached At UIHC?

In 2003, grants were available from the AHRQ to develop and test new technologies to improve patient safety. We submitted a proposal.

The aims of the proposal were to:

- Use bar code technology
- Use mobile wireless devices
- With a computerized system, require successful scans in all key steps involving patient identification in transfusion
- Evaluate and report the results
What was required to get the work done?

A multidisciplinary team had to:
1. Evaluate and select labels, printers, and computers on wheels (cows)
2. Evaluate, install and test a wireless system for all relevant care areas
3. Develop and validate the software
4. Undertake side-by-side pilot studies and then train over 1800 staff
5. Make a final, bite the bullet recommendation

Project Team

- Dr. Loreen Herwaldt, Professor, Co-Principle Investigator
- Lee Carmen, Chief Information Officer, Co-Principle Investigator
- Linda Chase, Associate Director of Nursing
- Lynn Comreid, Advance Practice Nurse
- Charlene Elbert, Assistant Manager, DeGowin Blood Center
- Deborah Greene, Manager, Quality Assurance Department of Pathology
- Mary Heintz, Clinical Laboratory Scientist III, DeGowin Blood Center
- Dr. Charles Helms, Professor, Chief of Staff
- Dr. John Kemp, Professor, Pathology
- Judy Levitt, Manager, DeGowin Blood Center
- Steve McGirane, Application Technical Lead on Bar Code Projects
- Aleta Porcella, Nursing Informatics
- Sheri Swartzendruber, Risk Project Manager
- Dr. Marta Tiltier, Director, Nursing Research, Quality and Outcomes Mgmt.
- Kristy Walker, Associate Director, Information Systems
- Jeffrey VandeBerg, Statistician

Slide courtesy of Judy Levitt
How does the system work?

There are four key scanning steps:

1. Sample collection
2. Sample arrival
3. Blood product dispense
4. Blood product administration

Blood Sample Collection
Blood Sample Arrival

Sample Arrival in Lab

You are required to follow these steps, in order:
1. Scan the patient identifier on the requisition.
2. Scan the patient identifier on the blood sample.

Bar Coded ID's Scanned

<table>
<thead>
<tr>
<th>Requisition</th>
<th>J1544395</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample</td>
<td>J1544395</td>
</tr>
</tbody>
</table>

OK | Cancel

Blood Product Dispense

Product Dispensied from Lab

You are required to follow these steps, in order:
1. Scan the patient identifier on the requisition.
2. Scan the patient identifier on the lab tag.
3. Scan the lab tag number on the lab tag.
4. Enter the unit number on the blood product.
5. Select the appropriate product from list.

Bar Coded ID's Scanned

<table>
<thead>
<tr>
<th>Blood Prod Unit No.</th>
<th></th>
</tr>
</thead>
</table>

OK | Cancel | Quit

[Additional images and information not transcribed]
Blood Product Administration

The system permanently records key details

1. Date
2. Location
3. Operator
4. The time of the initial scan and of the termination of the interaction
Awarded AHRQ Grant Sept 2003

Replaced Patient ID Bands Feb 2004

Progressive Pilot Apr 2004

Enabled Wireless Network Dec 2004

Trained 1,800 Clinicians Jan 2005

House-wide Implementation Feb 2005

New scanning operations added after the system was activated

- Scan for OR proxy
- Simplified scan for multiple blood products
- Scan for products returned to Blood Bank
Also, a new audit step was added after the system was activated

- Upon request, the system will compare products dispensed, administered, and returned - and shows discrepancies

- A member of the QA staff reviews and evaluates the data on a daily basis.

- PSNs created for all skipped scans (0.8%)

- Nursing QA or Anesthesia follow up with employees who fail to scan properly

So-what actually happened?

- The system was well-received.

- The system provided a powerful new way to comprehensively track and analyze errors in the transfusion process.
How are errors categorized in the computerized system?

Wrong step
- Operator selects wrong transaction

Mis-scan
- Operator fails to execute a proper scan

Skipped step
- A transaction is either never begun or left incomplete

Prevented identification error (PIE)
- A bar-code mismatch is detected

Focus: Prevented Identification Errors are detected at all steps

- Sample collection – 4.5 PIEs per month
- Sample arrival – 0.1 PIEs per month
- Blood product dispense – 5.3 PIEs per month
- Administration – 1.13 PIEs per month
Focus: Errors at the Administration Transaction

- Across the institution, PIEs are detected at administration ~ once every 27 days.
- Across the institution, the scan completion rate at administration is ~ 99%.
- If the processes are assumed to be independent, then a mis-transfusion event would be expected to occur about every 3236 days (~ 8.85 years) on average.

Potential Increase In Safety With The Bar Code Based Transfusion System

Based on the fact that we were previously likely experiencing mis-transfusions every 1.25 years, the new system may be about 7 times safer than its two-witness, two-signature predecessor.

Given that the national estimate of mis-transfusion is one per 12,000 units of RBCs, and that we transfuse about 155,300 units in 3236 days, the new system may be about 13 times safer than the national average.
How has the system changed things?

The system is now widely accepted as a critical patient safety function. Nursing and Anesthesia are very strong proponents.

The reliable and unambiguous nature of the data generated has driven further process analysis and improvement.

Options for Further Technological Enhancement

- Additional scanning steps for the ORs
- Unique identifier tags (digits) for barcodes used on patient wristbands
- Integration of RFID technology as it becomes more feasible and cost-effective
Again: The Major Points

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- Its use is steadily increasing
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Publications: UIHC Experience

- Enhancing Transfusion Safety With An Innovative Bar-Code-Based Tracking System. Askeland et al. Healthcare Quarterly 2009 Special Issue: 82-86
Operating Room Blood Scan Project

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Current Bar Code System

One of best in the world
Want to make it better
OR has highest volume of blood administrations
OR is 5th highest in percent of missed scans

OR Missed Scans – April 2010 – March, 2011
- 9901 total blood administrations
- 1.111% (n=110) missed scans
- Prevented Identification Errors (PIE) – 8
  - Red screen which will prevent administration of wrong blood
Software

Good

Not so good!

High Risk Process: Blood Transfusions

Blood scans in the OR

- Highest volume of blood administrations and highest number of missed scans
- Percent of missed scans low, but results could be catastrophic
- Most missed scans occur:
  - when multiple units are administered
  - due to a lapse of the person administering
What’s different in the OR?

Special to the OR

- Complex Environment
- Barcode wristband removed or inaccessible
- No RN administration
- Rapid, massive, transfusions
- Restricted, cluttered workspace
- Pre-checking multiple blood products
- Proxy & scanning new & alien to workflow
- Unforeseen bar-code insecurities
- OR workflow incompatible with EMR order management
Types of Scanning Errors in the OR

Low Risk and Most Common
- Proxy Error – Right blood, right patient, wrong patient displayed on computer screen

 Dangerous
- Wrong blood in the room
- How does this happen?
  - Wrong blood delivered to the OR – 2 person check not completed
  - Blood left in room from prior case
- If scanning is done, a Prevented Identification Error (PIE) is detected – red screen which will prevent administration of wrong blood

   ➤ No improper transfusion was ever given ➤

Failure Mode & Effect Analysis (FMEA)

Prospective review of a high risk/patient safety process

Analysis of possible failures in process steps

Process steps with highest risk analyzed based on:
- Occurrence
- Detection
- Severity
Multi-disciplinary Team

- Quality and Safety Office
- Anesthesiology
- Operational Improvement
- Perioperative Nursing Services
- Clinical Laboratory
- Cardiovascular Perfusion Program
- Pathology Blood Bank Quality Assurance

Before FMEA
Identified Potential Failure Modes

19 potential failure modes identified

Summary of failure modes that were addressed – most related to patient identification:
1. Epic and/or IPR tab for another patient open on desktop
2. Proxy to the wrong patient
3. Wrong blood in refrigerator
4. Blood product not scanned prior to administration
5. No standard location for patient identification labels
6. Epic and/or IPR screens left up with prior patient

Recommendations

7 recommendations – 4 Sustained
1. Anesthesia has one unique patient identification proxy in a standardized location in all ORs for all patients
2. Perfusion has one unique proxy, in a standardized location
3. Computer synchronization as a part of the patient identification step
4. Computer screen located at pneumatic tube station for blood pick-up location. Replaces paper log of patient room assignments
5. Installation of computers dedicated for Perfusionist use for blood scanning
6. Patient labels in designated locations for each discipline – working for anesthesia
7. Clean sweep of all ORs after each case of all paper and electronic patient identifiers
After FMEA
Proxy is in Correct Location

After FMEA
Proxy has been removed
After FMEA

Proxy for All

Percent of Missed Blood Scans in the OR
Questions?

Thank you!
Achieving Patient Safety through Wireless Electronic Transfusion Verification System and Bar Code Scanning

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Texas Medical Center
Houston, Texas

- First hospital in Texas designated a Magnet hospital for nursing excellence by the ANCC
- Ranked by U.S. News & World Report among the nation’s top 50 centers in cardiology, digestive disorders, endocrinology, geriatrics, kidney disease, neurology and neurosurgery, orthopedics, respiratory and urology.
- Licensed for 864 beds, including 157 ICU beds, 36 OR suites & 12 ambulatory OR suites.

St. Luke’s Episcopal Hospital
Houston, Texas

- First hospital in Texas designated a Magnet hospital for nursing excellence by the ANCC
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Overview

- In 2006, more than 30 million blood products were transfused; of which 14.7 million were red blood cells (RBC).

- An estimated total of 72,000 transfusion-related adverse reactions were reported for 2006.

Overview

- SLEH Experience – Approximately 6,000 blood products are transfused per month of which 2,600 are RBC and cell – saver blood.
Joint Commission Standards

- NPSG.01.01.01: Use at least two patient identifiers when providing care, treatment, and services.
  - Rationale for NPSG.01.01.01:
    Wrong-patient errors occur in virtually all stages of diagnosis and treatment. The intent for this goal is two-fold: first, to reliably identify the individual as the person for whom the service or treatment is intended; second, to match the service or treatment to that individual.
  - Goal 1:
    Improve the accuracy of patient identification.

- NPSG.01.03.01: Eliminate transfusion errors related to patient misidentification.

A Case of Transfusing Mismatched Blood

- 75 year old patient
- Cardiovascular disease
- Intensive Care Unit
- Hemoglobin = 7.4 mg/dL
- Order to transfuse 2 units of blood
- Transfusion Service (Blood Bank) called that the blood was ready
A Case of Transfusing Mismatched Blood

- RN removed the blood product requisition form in the patient's kardex binder
- Form handed to the patient care assistant (PCA) who went to pick up the blood
- 2 RNs verified patient's armband with the medical record
- Interrupted by another patient.
- Verification process continued by 2 RNs: blood unit, blood tag, & product requisition form.
- Did not verify blood tag with patient's armband.

Patient's Outcome

- Blood was administered to the patient.
- Blood had another patient's name on it.
- Patient received ABO-incompatible blood
Possible Outcome for the RNs

- Corrective Action – Discharge
- Nursing Peer Review → Report to Texas Board of Nursing
  Or
- Report to Healthcare Alliance Safety Partnership (HASP)
Healthcare Alliance Safety Partnership (HASP)

- An alternate reporting and review process approved by the Texas Board of Nursing for nurses who wish to self-report errors.

- A pilot program that adapts the airline industry’s Aviation Safety Action Partnership (ASAP) to healthcare.

- Identified areas for individual and organizational improvement.

- Recommended interventions designed to increase the safety of patient care.

Purpose of HASP

- To improve the environment of patient and practitioner safety by increasing the understanding of both human performance and system factors contributing to adverse medical events and/or occurrences involving nurse actions.
Contributing Factors Identified:

- Technical factors = 4
- Organizational factors = 26
- Human factors = 14
- Patient factors = 8

Contributing factors

- Lack of communication between the PCA and the transfusion technician
- Use of incorrectly addressographed form
- Distraction from the confused patient and the roundings from physicians.
- Incomplete blood verification process
ISBT – 128

- Established by the International Society of Blood Transfusion

- In conjunction with technology software electronically cross matches donor and recipient for ABO compatibility

- Tracks the blood product and manages data
Our Path towards Blood Transfusion Safety

1993 - Preprinted Labels
1997 - Barcoded Armbands & Meds
2006 - Transfusion Verification
2009 - Specimen Collection Verification

Our Path towards Patient Safety

2002 - International Society of Blood Transfusion (ISBT) for blood labeling was implemented
2006 - Wireless electronic transfusion verification technology
2008 - Access to duplicate ID barcoded armband labels removed
2009 - All blood transfusion orders through the use of Computerized Physician Order Entry (CPOE)
2009 - Specimen Collection Verification
Purpose of the Use of Technology

- Allows licensed healthcare professionals/authorized users to simultaneously transfuse and document administration information at the patient bedside.

- Maximizes patient safety by enforcing bar code scanning of the patient wristband and the blood product as identified and released by the blood bank to be transfused within the allowable product release time.

- Provides an automated printed transfusion report for each blood product infused.

Patient Verification

- Scan Patient Armband on patient ARM.
Patient Verification

Check two patient identifiers

BLOOD PRODUCT BARCODES

1. Scan the unit number barcode on the blood product bag.

2. Then scan the product code barcode. (The second barcode on the left.)
Start of Transfusion

The blood product unit has been successfully matched to the patient. Tap the 'Begin' button to begin the transfusion.

Begin Close

Viewing Blood on Transfusion

Orders

User: Gecono, Jonathan
Patient: BLOODCARE, ELEVEN (0721000)
Blood Type: B POS

<table>
<thead>
<tr>
<th>Unit ID</th>
<th>Issue Date/Time</th>
<th>Status</th>
<th>Priority</th>
<th>Unit Blood Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>W056207001350</td>
<td>03/26/10 05:37:00</td>
<td>Routine</td>
<td>B POS</td>
<td></td>
</tr>
</tbody>
</table>

Transfusing

Status Type

Transfusion Activities

<table>
<thead>
<tr>
<th>Active</th>
<th>Routine</th>
<th>B Neg</th>
</tr>
</thead>
<tbody>
<tr>
<td>RED BLOOD CELLS</td>
<td>03/26/10 05:37:00</td>
<td></td>
</tr>
</tbody>
</table>

Close

Action Patient Options

Cultivating Patient Safety
It's In Our Hands: Sharing Accountability and Responsibility
Viewing Blood on Transfusion

Alert for Stopping Transfusion
Stopping Transfusion

Rate & Errors for Utilizing Transfusion Verification

<table>
<thead>
<tr>
<th>Monitor</th>
<th>Oct-07</th>
<th>Nov-07</th>
<th>Dec-07</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Products transfused with Bloodcare</td>
<td>50%</td>
<td>62%</td>
<td>65%</td>
</tr>
<tr>
<td>% Products transfused with Bloodcare in CVOR</td>
<td>14%</td>
<td>20%</td>
<td>16%</td>
</tr>
<tr>
<td>1) Patient ID not Scanned</td>
<td>21</td>
<td>36</td>
<td>15</td>
</tr>
<tr>
<td>2) Incorrect Completion Time- Presumed Transfused</td>
<td>78</td>
<td>106</td>
<td>42</td>
</tr>
<tr>
<td>3) Units issued on incorrect account</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Rate for Utilizing Transfusion Verification

Errors

- % Products transfused with Bloodcare
- % Products transfused with Bloodcare in CVOR
- % Products transfused with Bloodcare in Main OR

Errors

- Patient ID not Scanned
- Incorrect Completion
- Time-Presumed Transfused
- Units issued on incorrect account
Reference


Reference


Questions

Thank you!