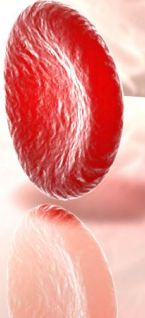


Blood Management: Improve Transfusion, Decrease Costs!

Risks of Transfusion
Blood Management Issues
Strategies to Implement
Example of UAB Hospital

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What is “Blood Management”?

- Strategies to avoid unnecessary transfusion, including
 - Use of a restrictive Hb threshold of 7 g/dL for transfusion (excluding acute hemorrhage, coronary disease, hemoglobinopathies)
 - Order single unit transfusion, then re-evaluate
- Strategies to preserve patient’s Hb
- Multidisciplinary efforts for improved outcomes

NOT under-transfusion or over-transfusion



3 Goals of All Hospitals

1. Improve quality
2. Reduce costs
3. Improve customer service

Conservative blood management addresses all 3



Priorities of Blood Management

1. Improve Quality of Patient Outcomes

- Reducing risks of transfusion
 - TRALI
 - TACO
 - TRIM
 - Mishap
- Reduce hospital acquired infections
- Use restrictive transfusion practice (equal or improved outcome compared to liberal transfusion policies)
- Lower iatrogenic blood loss
- Order single unit transfusions, re-evaluate
- Monitor blood utilization



Priorities of Blood Management

2. Reduce Costs

- Costs of blood
- Costs of testing
- Costs of administering
- Costs of extended care

3. Conserve donor blood

- Huge demand for blood; limited supply



Blood Transfusions More Than Double Since 1997



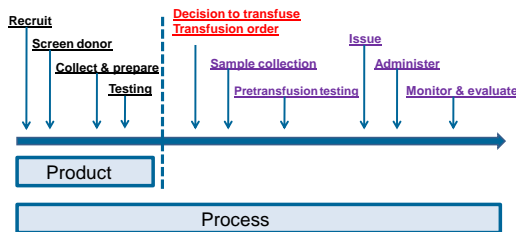
- AHRQ News and Numbers September 24, 2009
- The number of hospital stays for patients who received blood transfusions increased by 140 percent (from 1.1 million to nearly 2.7 million) between 1997 and 2007, representing the largest increase in procedures not involving pregnancy or childbirth over the 11-year period, according to the latest News and Numbers from the Agency for Healthcare Research and Quality (AHRQ).



Risks of Transfusion

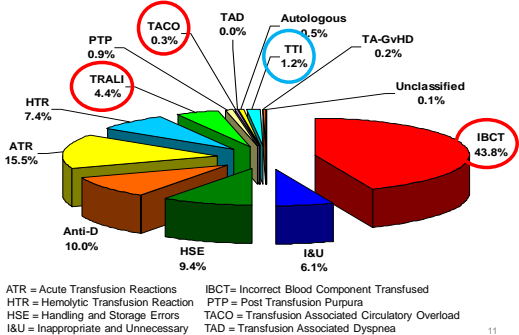


Safe transfusion is a **process** of interdependent steps from the donor to the patient



Modified from: Dzik, WH, Transfusion Vol. 43: 1190-1199

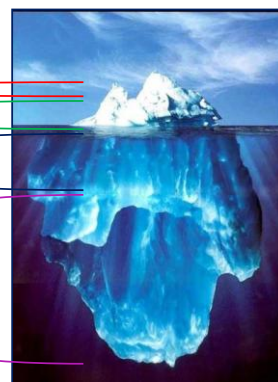
SHOT – Serious Hazards of Transfusion (United Kingdom)
Cumulative Data 1996-2008 (5374 cases)

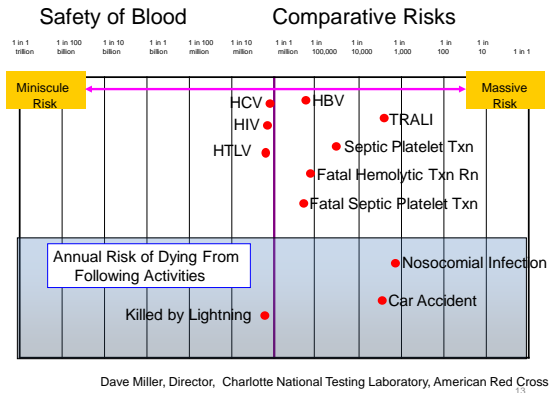


The Iceberg Model In Transfusion

Fatal HTR-- 1:600,000 +
 ABO incompatible transfusion-- 1:40,000
 Wrong blood given-- 1:14,000

Near miss errors ?





Risks & Adverse Effects of Transfusion

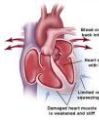


- Hemolytic reactions- acute or delayed
- Febrile Nonhemolytic
- Allergic
- Anaphylactic
- Bacterial contamination
- Disease transmission
- Alloimmunization
- Transfusion associated circulatory overload (TACO)
- Transfusion related acute lung injury (TRALI)
- Transfusion related immune modulation (TRIM)
- Transfusion associated Graft-vs Host Disease (TA-GVHD)
- Post-Transfusion Purpura (PTP)

TACO

Transf-assoc circulatory overload

Rapid infusion, excess volume infused, cardiac insufficiency



- Occurs during or shortly after transfusion
- Cough, dyspnea, cyanosis, headache, tachycardia
- Respiratory distress, hypoxemia
- Pulmonary edema
- Increased left atrial pressure, congestive heart failure, ↑ NT-proBNP
- Hypertension
- Rapid improvement with diuresis

TRALI

Transf-related acute lung injury

Donor neutrophil or HLA class I or II antibodies to recipient antigens, or biologic response modifiers; inflammatory response; plasma leaks from damaged capillaries into lungs



- Onset within 6 hours of transfusion
- Cough, dyspnea, cyanosis, fever
- Respiratory distress, acute hypoxemia
- Noncardiogenic pulmonary edema, bilateral infiltrates
- No evidence of left atrial hypertension (circulatory overload)
- Hypotension (but 15% present with hypertension)
- 80% improve within 48-96 hours, mortality is 5-10%

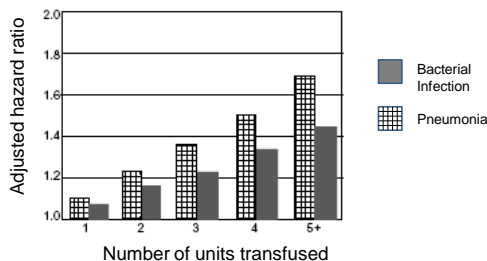
Transfusion Related Immunomodulation (TRIM)



- Transfusion recipients, vs. non-transfused, have
 - improved survival of renal allografts
 - higher risk of post-operative infection
 - increased risk of cancer recurrence?
- Proposed mechanism of TRIM
 - Enhanced Th2 (humoral immunity) response
 - Down regulation of Th1 (cellular immunity) response
 - Possible pro-inflammatory and prothrombotic features

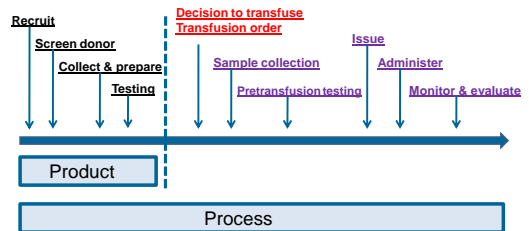
Blumberg N. Transfusion 2005;45:33S-9S
 Yazer MH, Triulzi DJ, Shaz B, Kraus T, Zimring JC, Blumberg N. Transfusion 2009; 49:6, 1070-1075
 Heal JM, Phipps RP, Blumberg N. Transfusion 2009; 49:6, 1032-1036

Association of Number of Units Transfused and Serious Bacterial Infection



Carson, et al. Transfusion 1999; 39:694-700

Safe transfusion is a process of interdependent steps from the donor to the patient



Modified from: Dzik, WH, Transfusion Vol. 43: 1190-1199

Decision to Transfuse

- Avoid unnecessary transfusion
 - Avoid risks
 - Conserve donor blood
 - Reduce costs
- Use restrictive transfusion policies
 - decrease the amount and costs of blood transfused, and
 - the patient's exposure to risks,
 - with equal (or improved) outcomes as compared to more liberal transfusion policies



Restrictive (Conservative) Red Cell Transfusion Trigger

- RBC transfusion trigger **Hb < 7 g/dL, hematocrit < 21%**
 - For patients with normal blood volume
 - Include assessment of patient's clinical condition
 - Not for serious cardiac disease, acute blood loss, hemoglobinopathies
- Conservative transfusion trigger reduces the number of
 - Units transfused
 - Patients transfused
 - Units a patient receives
 - Inappropriate transfusions
- Outcome
 - Transfusion requirements decreased without affecting outcome
 - Mortality, rates of cardiac events, morbidity, and length of stay unaffected or slightly improved, compared to liberal strategy (<10g/dL)



Hill S, Carless PA, Henry DA, Carson JL, Hebert PPC, Henderson KM, McClelland B. Transfusion thresholds and other strategies for guiding allogeneic red blood cell transfusion. *Cochrane Database of Systematic Reviews* 2000, Issue 1. Art. No.: CD002042. DOI: 10.1002/14651858.CD002042

Transfusion Requirements in Critical Care (TRICC)

	Restrictive Strategy Hb <7 g/dL Maintain 7-9 g/dL	Liberal Strategy Hb <10 g/dL Maintain 10-12 g/dL
30 d Mortality	18.7 %	23.3
Average # units transfused/pt	2.6	5.6
NO transfusion given	33%	0



Hebert PC, Wells G, Blajchman MA. *N Engl J Med* 1999;340:409-17

Transfusion Requirements in Critical Care (TRICC)

	Restrictive Strategy Hb <7 g/dL Maintain 7-9 g/dL	Liberal Strategy Hb <10 g/dL Maintain 10-12 g/dL
Myocardial infarction	0.7 %	2.9
Pulmonary edema	5.3	10.7
Adult respiratory distress syndrome	7.7%	11.4



Hebert PC, Wells G, Blajchman MA. *N Engl J Med* 1999;340:409-17

More Studies

- ABC:
 - Vincent JL, et al. Anemia and blood transfusion in critically ill patients. *JAMA* 2002 Sep;288(12):1499
- CRIT
 - Corwin HL, et al. The CRIT study: anemia and blood transfusion in the critically ill—current clinical practice in the United States. *Crit Care Med* 2004 Jan;32(1):290-1
- ATICS
 - Walsh TS, et al. Red cell requirements for intensive care units adhering to evidence-based transfusion guidelines. *Transfusion* 2004;44:1405-1411



Transfusion practice in the intensive care unit: a 10-year analysis

	1997	2007	P
Patients transfused	31%	18%	p <0.001
Mean units per patient transfused	4.3 ± 4.7	3.0 ± 3.8	p <0.001
Single unit transfusions	40.2%	53.1%	p = 0.03
Mean pretransfusion Hb	7.9 g/dL	7.3 g/dL	p <0.001



Netzer G, et al. *Transfusion* 2010

Single Unit Transfusions

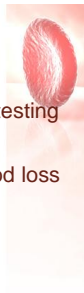
- Eliminate the “2-unit transfusion” rule
- Transfuse one unit, re-evaluate



Reducing Blood Loss from Sampling

- Up to 17% of blood loss due to sampling for testing
- Indwelling catheters: test volume + discards
- Vincent et al JAMA 2002 : Average daily blood loss from sampling is 41 mL/day
- UAB
 - Before: average 69 mL/day/ICU patient
 - After: average 39 mL/day/ICU patient
- Use of blood conserving device associated with smaller decrease in Hb in ICU patients, & 48% reduction of RBC transfusion

Mukhipadhyay et al, Crit Care 2010



Blood Conserving Device Example: VAMP

VAMP® (venous arterial blood management protection) sampling systems feature a blunt cannula design that eliminates needle sticks and a reservoir that conserves blood and ensures consistent sampling. Their self-sealing Z-site sampling port enables the collection of undiluted samples while greatly reducing the buildup of residual blood.



Reducing Blood Loss from Sampling

- Use blood conserving device on tubing that eliminates discards (VAMP)
- Point-of-Care testing
- Microchemistry techniques
- Review sample requirements
 - Example: UAB BB changed from 2 tubes (14 mL) to 1 tube (4 mL) Results: 116 gallons (1800 units) saved!
- Reduce re-draws by nurse education on type of sample and minimum volume
- Store blood samples for potential subsequent use



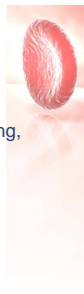
Lower Iatrogenic Blood Loss

- Provide cards with ordering information and risks to physicians
- Improve blood salvage in surgery



Alternatives to transfusion

- Limited blood draws, decreased testing, POC testing, small volume sampling, minimally invasive surgery
- Fluid replacement- D5W, Ringer’s lactate, saline
- Albumin, Plasma Protein Fraction
- Intraoperative or post-op blood salvage
- Acute normovolemic hemodilution
- Oxygen therapeutics (blood substitutes)
- EPO- erythropoietin (but poorer outcomes shown for cancer patients)
- Recombinant VIIa, coag factor concentrates
- Fibrin glue
- Hemostatic drugs, anti-fibrinolytics, tranexamic acid



Reduce Cost

- Costs of blood product
- Costs of testing
- Costs of administering
- Costs of care for transfusion complications, increased LOS (length of stay)



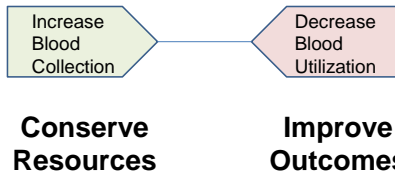
University of Alabama at Birmingham Hospital: Blood Management Initiative

- In 2007, UAB was the 4th largest purchaser of blood from the American Red Cross in the US
- Projected to need 45,000 units
- Collected only 3000



Marques M, Waldrum M, Hannon T. AABB Annual Meeting 2009

UAB Goals & Vision 2007



Marques M, Waldrum M, Hannon T. AABB Annual Meeting 2009

How? The UAB Experience

- Audit current practice, compare to benchmarks
- Identify gaps in performance
- Communicate with clinicians
 - Educate: risks and how to decrease
 - Ask other hospital committees to review proposals
 - Ask "is there anything different in your particular specialty that we need to consider?"
- Implement plan
 - Key people to coordinate
- Monitor blood utilization management
 - Transfusion practices
 - Adverse events
 - Wastage of units

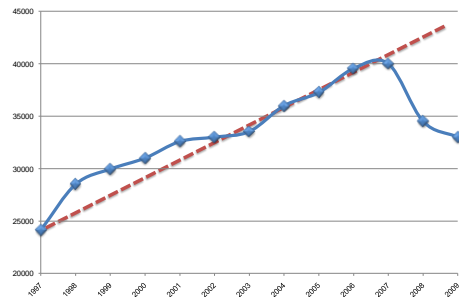
Marques M, Waldrum M, Hannon T. AABB Annual Meeting 2009

Key Aspects of Implementation

- Education on blood management:
 - Risks of transfusion
 - Transfusion triggers & outcome studies
 - Alternatives to transfusion
- Develop a multidisciplinary transfusion committee
 - Establish transfusion threshold of 7 g/dL (w/ exceptions)
 - Eliminate the 2 unit order
 - Reduce blood loss due to sampling
- Develop mechanisms to monitor transfusion practice and audit & track compliance
 - Feedback on performance

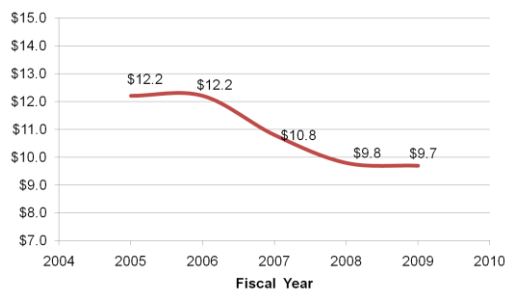
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Decrease in Blood Utilization from 40,000 to 33,000 Units



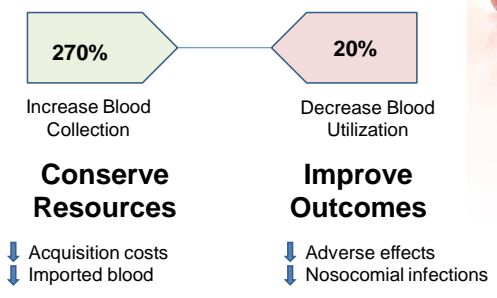
Marques M, Waldrum M, Hannon T. AABB Annual Meeting 2009

Decreased Cost of Blood Products by \$2.5 Million



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UAB Goals & Vision 2009



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Blood Management

