

Blood Transfusion Project

Reducing Transfusion in the MARCQI Population





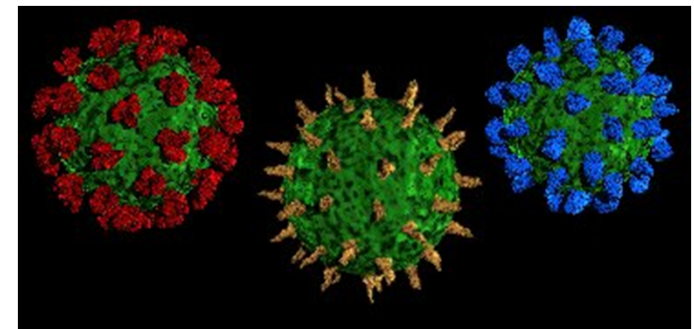
Anemia in Healthy Awake Volunteers

- Critical hemoglobin threshold unknown in humans
- At 6 g/dL
 - Decline in cognitive function
- At 5 g/dL
 - VO_2 maintained
 - ST changes in 5%
 - Memory formation impaired

Lieberman, et al. Anesthesiology 2000

Risks of Blood Transfusion

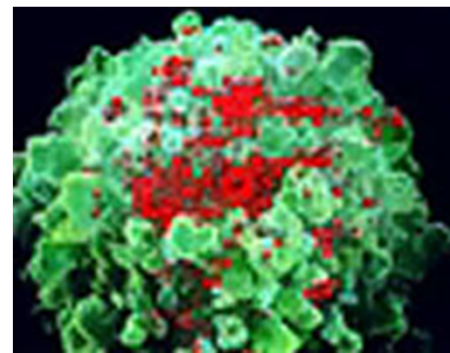
- Viral transmission
- Acute transfusion reactions
- Immunosuppression
- Acute inflammatory response



Infection



Noninfectious Hazards

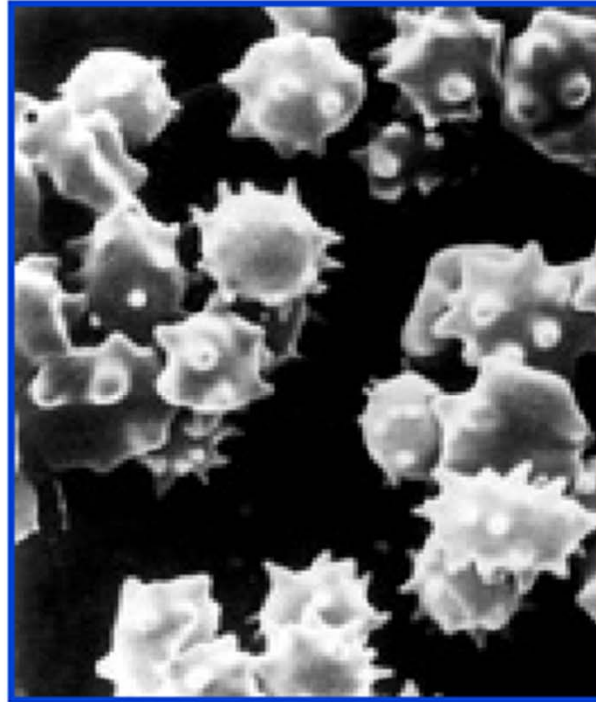


Immunosuppression

Age of Stored Blood



Day 1



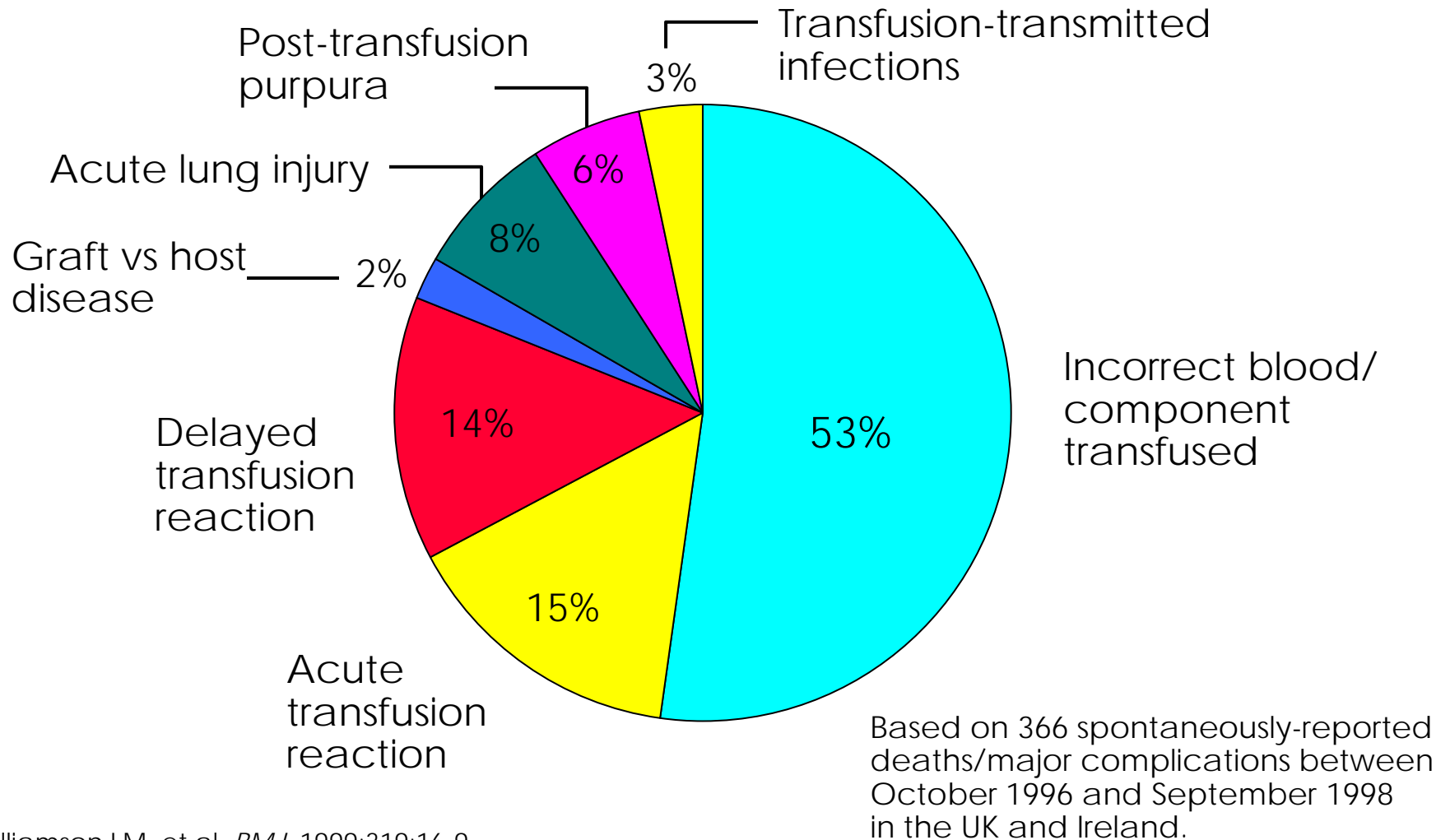
Day 21



Day 35

Hovav et al. Transfusion. 1999; 39: 277-281.

Serious Hazards of Transfusion



Immune Effects of Blood

- Decreased T-cell proliferation
- Decreased CD3, CD4, CD8 T-cells
- Increased Cell-mediated lympholysis
- Increased TNF-alpha
- Increased suppressor T-cell activity
- Reduced natural killer cell activity

TRIM – Transfusion-associated Immunomodulation

McAlister FA, et al, British Journal of Surgery 1998; 85: 171-178
Innerhofer et al. Transfusion 1999 Oct;39(10):1089



Blood Transfusion Increases Risk of Postoperative Bacterial Infection

- 20 peer-reviewed studies, 1986-2000
- 13,152 patients
 - 5215 transfused
 - 7937 not transfused
- Association of Transfusion to Infection
 - OR 3.45 (range 1.43-15.15)
 - 17 of 20 studies with $p < 0.05$

Hill GE, Minei JP et al. J Trauma 2003;54:908-914



Predictors and Complications of Blood Transfusion in Total Hip and Knee Arthroplasty

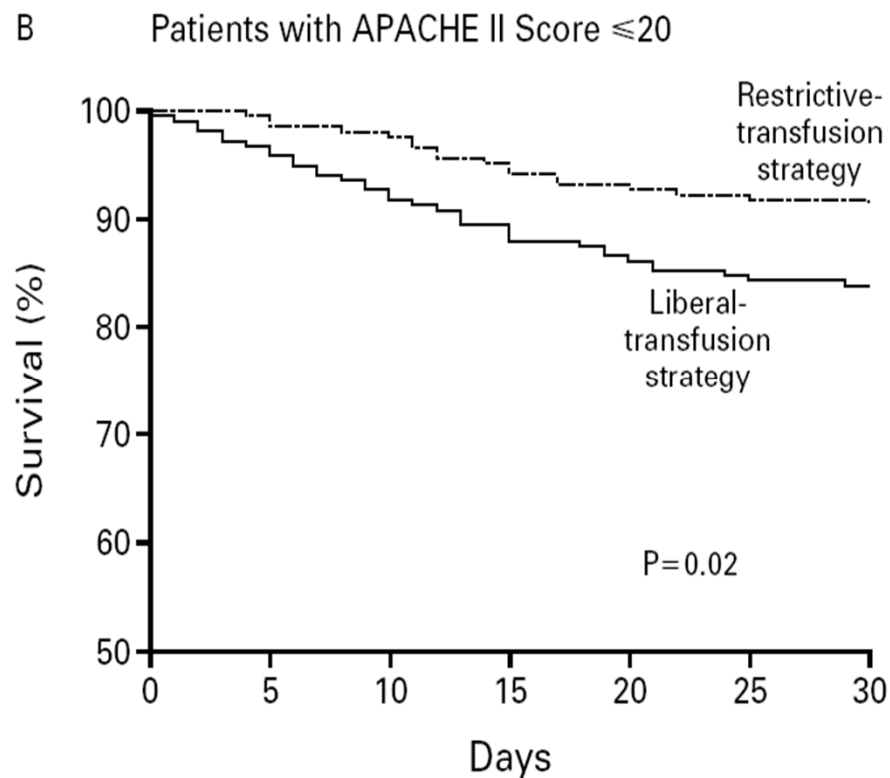
- Henry Ford Hospital
- Jan 2011 to Dec 2012
- 1573 patients
- 13.3% higher infection rate in transfused patients
- Factors associated with transfusion
 - Age
 - Female gender
 - BMI

Frisch, et al. AAHKS 11/2013

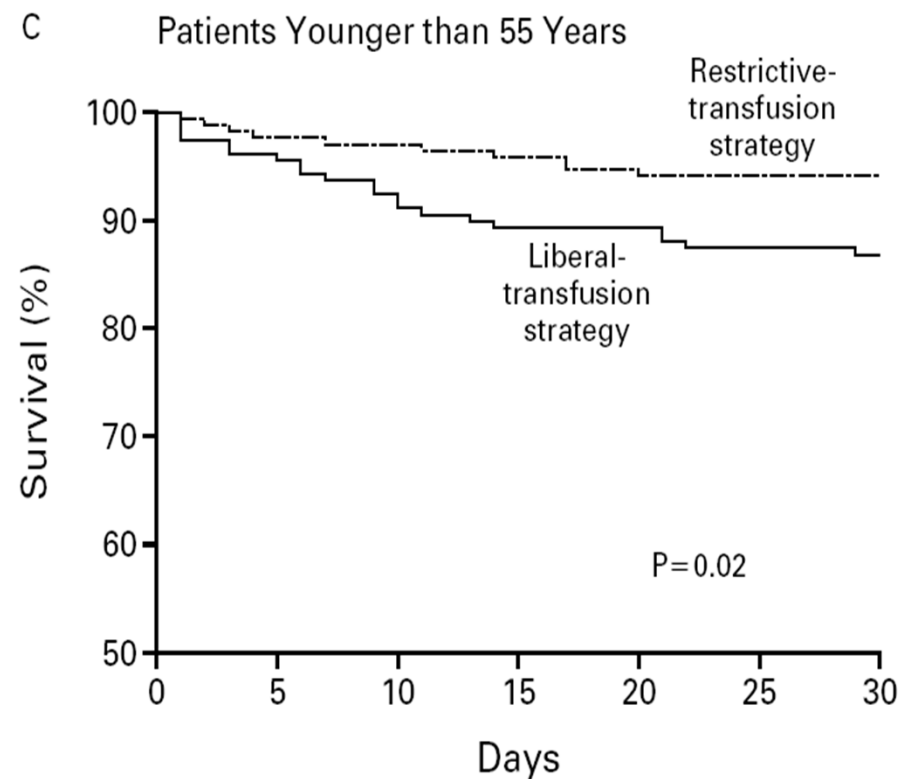
The TRICC Study

- 838 patients ICU patients
- Placed into one of two groups
 - **Restrictive group:**
 - Transfuse if Hb < 7
 - Maintain between 7 and 9
 - **Liberal group:**
 - Transfuse if Hb < 10
 - Maintain between 10 and 12
- The primary outcome measure was death from all causes in the 30 days after randomization

Herbert PC, et al. NEJM 1999



8.7% vs 16.1%



5.7% vs 13.0%

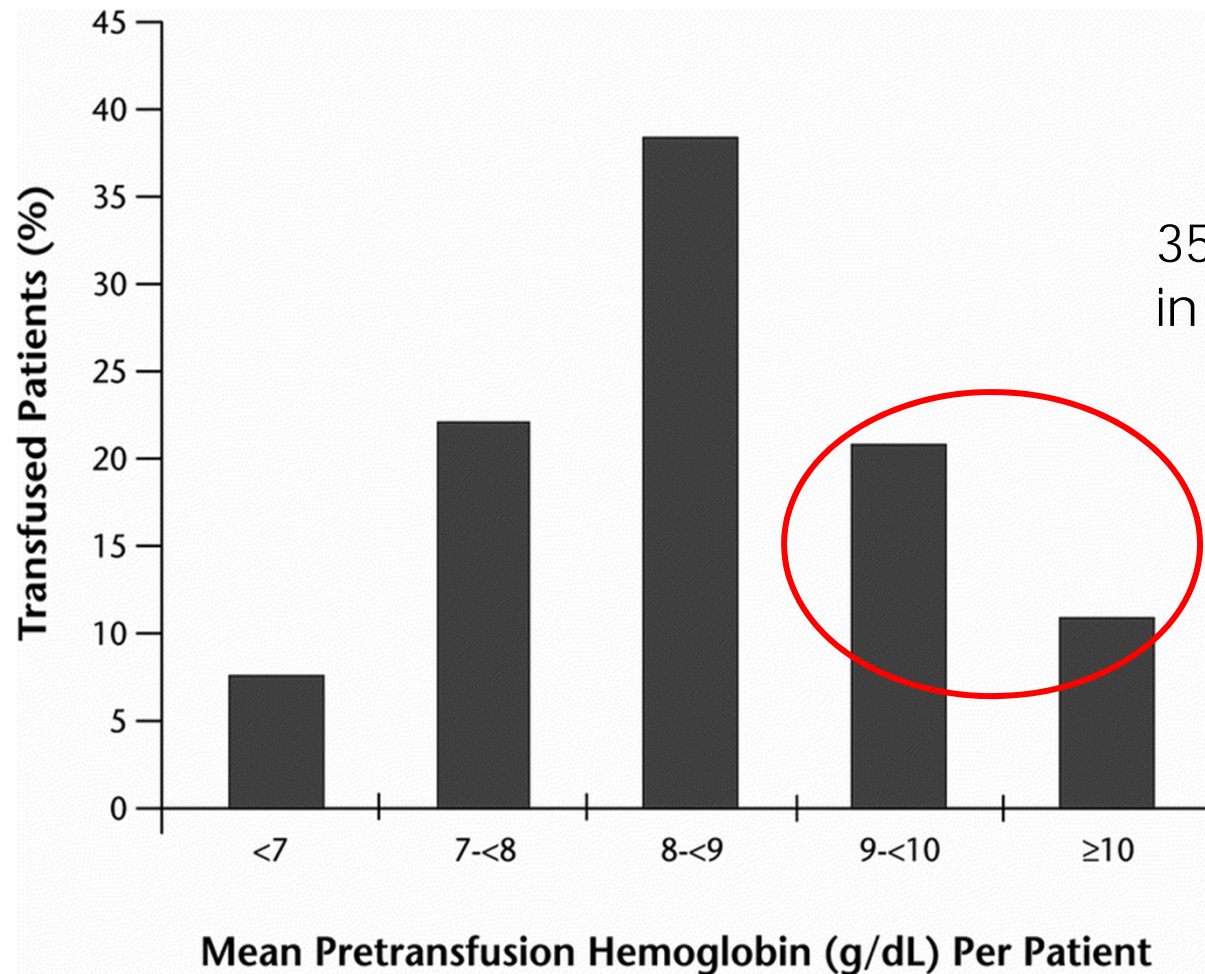
Herbert PC, et al. NEJM 1999

CRIT Study

- 4,892 ICU patients in the US
- Prospective, multiple center, observational cohort
- Examine the relationship of
 - Anemia
 - RBC transfusion
 - Clinical outcomes

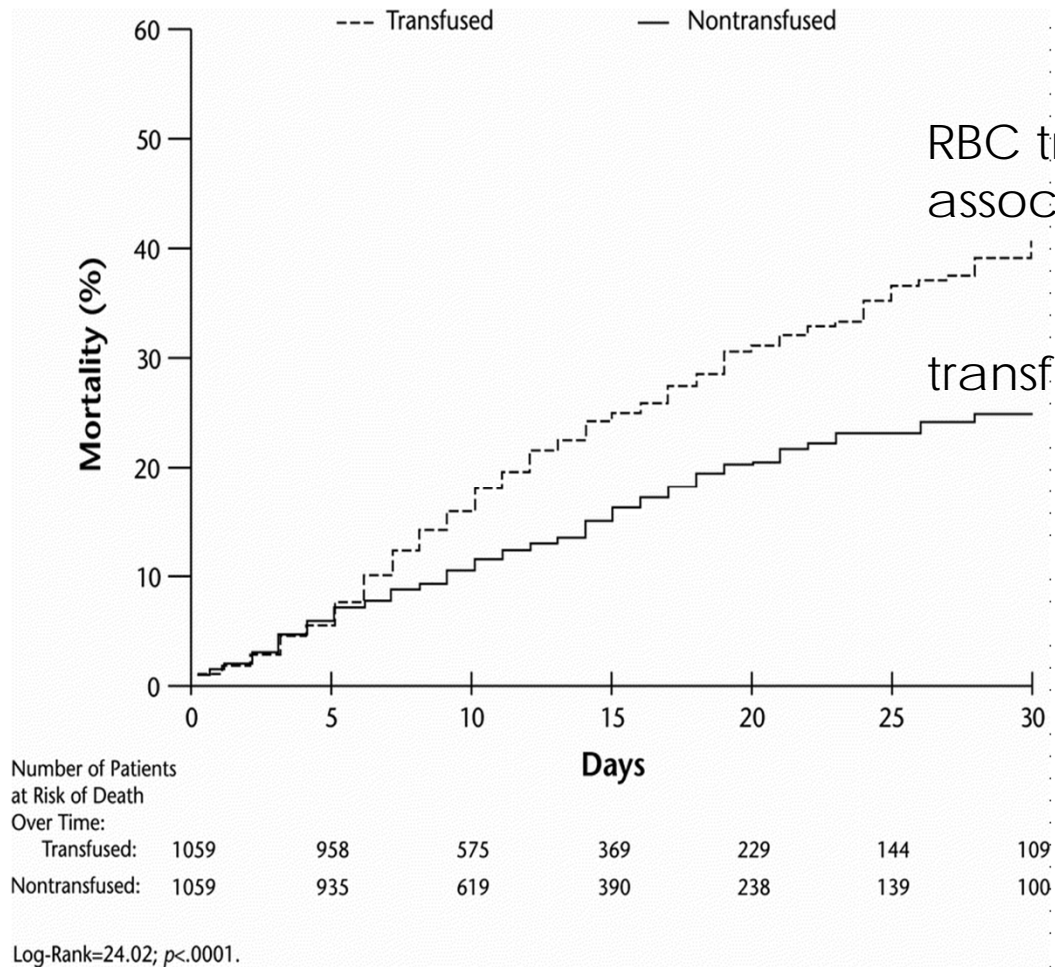
Crit Care Med. 2004 Jan;32(1):39-52

CRIT Results



Crit Care Med. 2004 Jan;32(1):39-52

CRIT Results



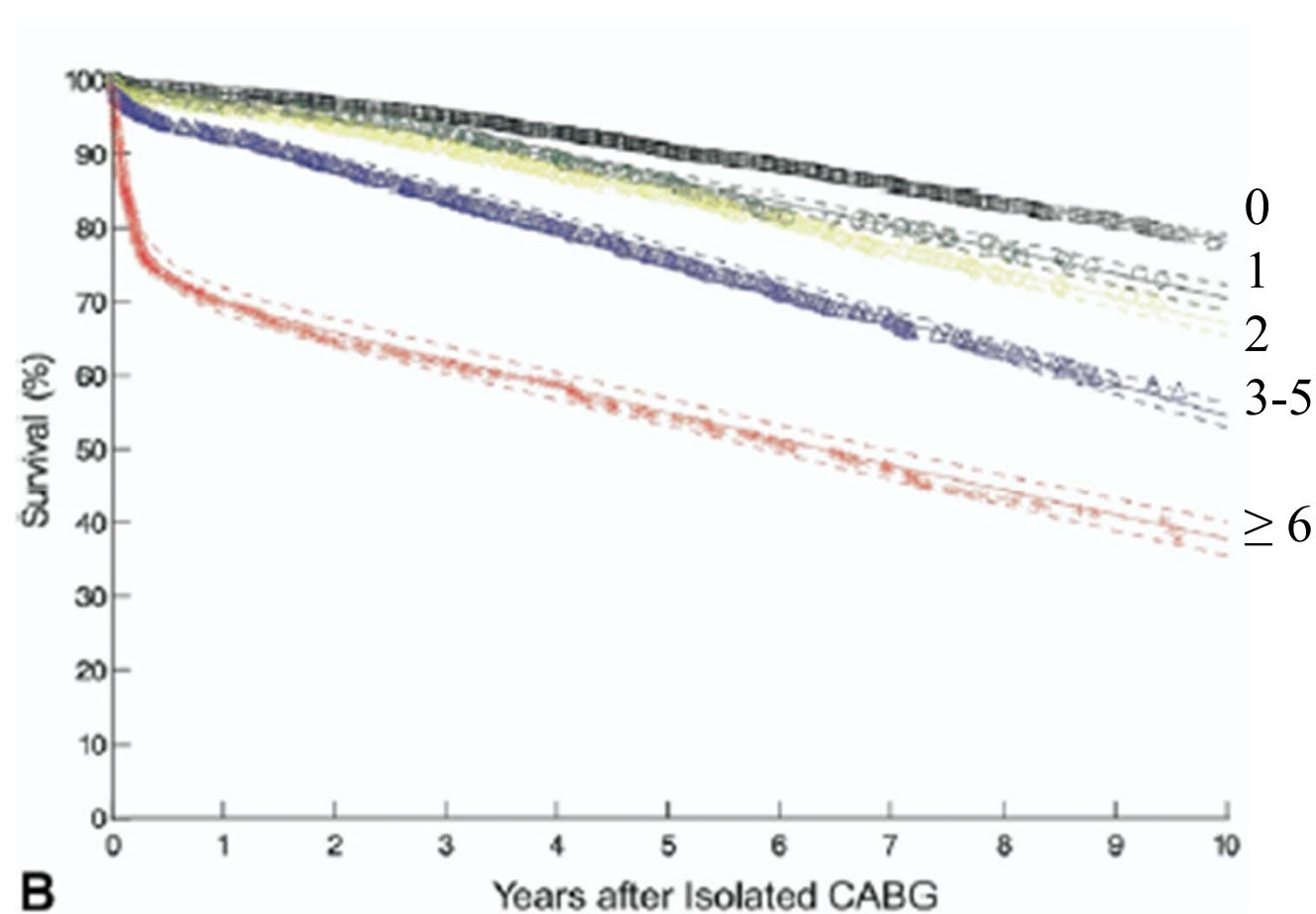
RBC transfusion was independently associated with higher mortality
 OR 1.65 (CI 1.35-2.03)
 OR 2.62 if 3-4 units transfused

Crit Care Med. 2004 Jan;32(1):39-52

Transfusion in Coronary Artery Bypass Grafting is Associated with Reduced Long-Term Survival

Colleen Gorman Koch, MD, MS, Liang Li, PhD, Andra I. Duncan, MD, Tomislav Mihaljevic, MD, Floyd D. Loop, MD, Norman J. Starr, MD, and Eugene H. Blackstone, MD

Departments of Cardiothoracic Anesthesia, Quantitative Health Sciences, and Thoracic and Cardiovascular Surgery, The Cleveland Clinic Foundation, Cleveland, Ohio





FOCUS Trial

- Inclusion criteria:
 - Undergo surgery for hip fracture
 - Have a history of cardiovascular disease
 - Have a postoperative Hgb < 10 g/dL
- Randomized to keep Hgb > 10 g/dL or not
- Primary outcome
 - Ability to walk 10 feet without assistance at 60 days
- Negative outcomes
 - Postoperative unstable angina
 - Myocardial infarction
 - Death

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Liberal or Restrictive Transfusion in High-Risk Patients after Hip Surgery

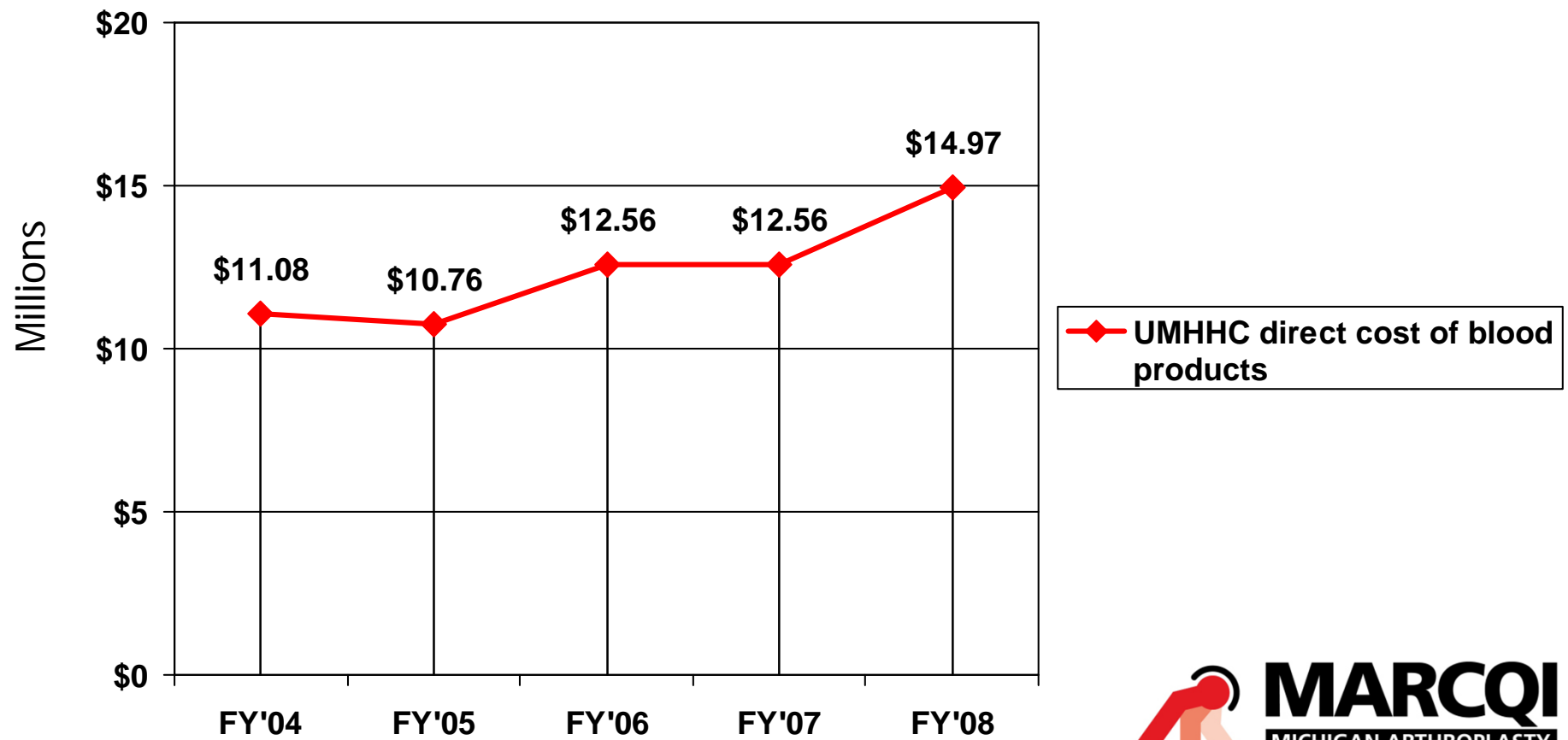
Jeffrey L. Carson, M.D., Michael L. Terrin, M.D., M.P.H., Helaine Noveck, M.P.H., David W. Sanders, M.D., Bernard R. Chaitman, M.D., George G. Rhoads, M.D., M.P.H., George Nemo, Ph.D., Karen Dragert, R.N., Lauren Beaupre, P.T., Ph.D., Kevin Hildebrand, M.D., William Macaulay, M.D., Courtland Lewis, M.D., Donald Richard Cook, B.M.Sc., M.D., Gwendolyn Dobbin, C.C.R.P., Khwaja J. Zakriya, M.D., Fred S. Apple, Ph.D., Rebecca A. Horney, B.A., and Jay Magaziner, Ph.D., M.S.Hyg., for the FOCUS Investigators*

CONCLUSIONS

A liberal transfusion strategy, as compared with a restrictive strategy, did not reduce rates of death or inability to walk independently on 60-day follow-up or reduce in-hospital morbidity in elderly patients at high cardiovascular risk. (Funded by the National Heart, Lung, and Blood Institute; FOCUS ClinicalTrials.gov number, NCT00071032.)

N Engl J Med 2011;365:2453-62.

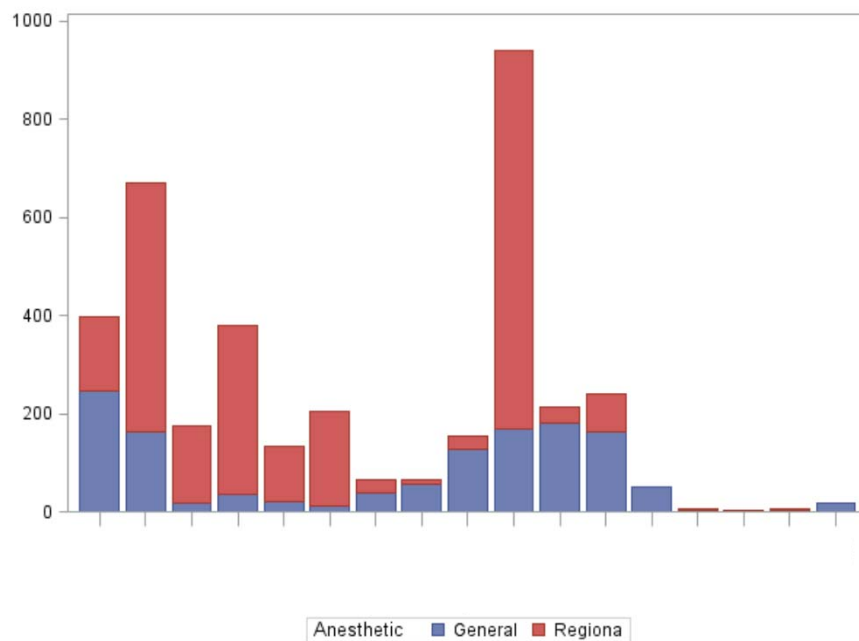
Financial Burden



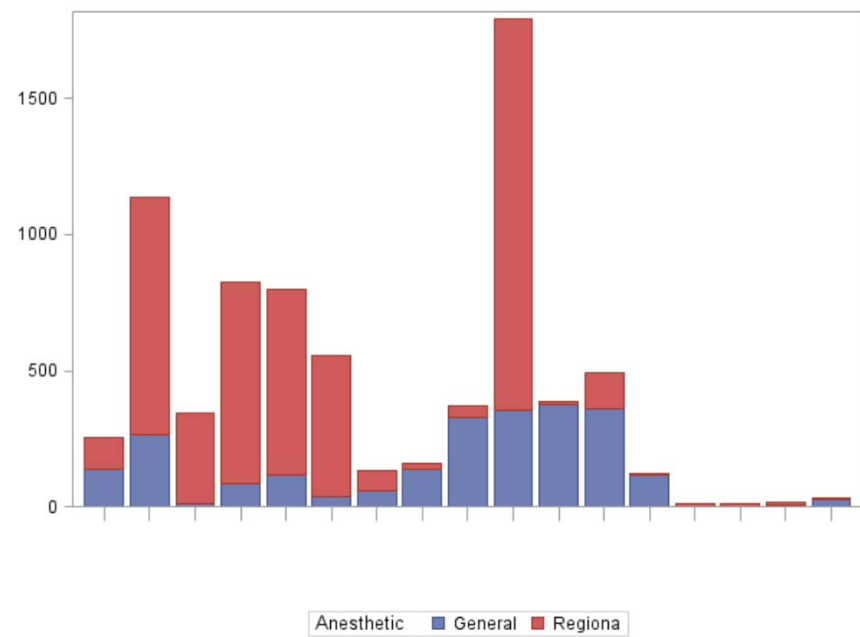
Exploring Surgery Level Risk Factors for Transfusion and Readmission

General versus regional anesthesia

Hip



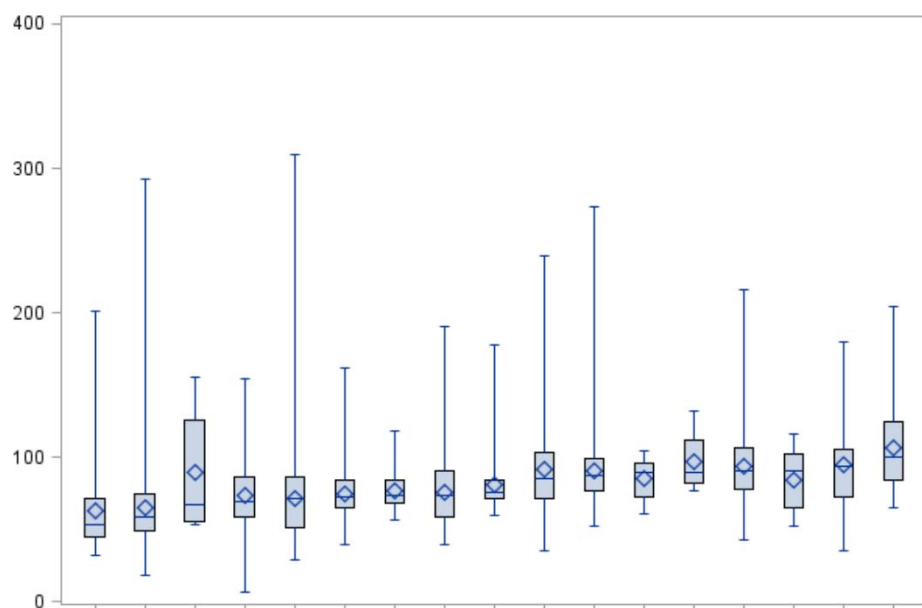
Knee



Time in OR by hospital

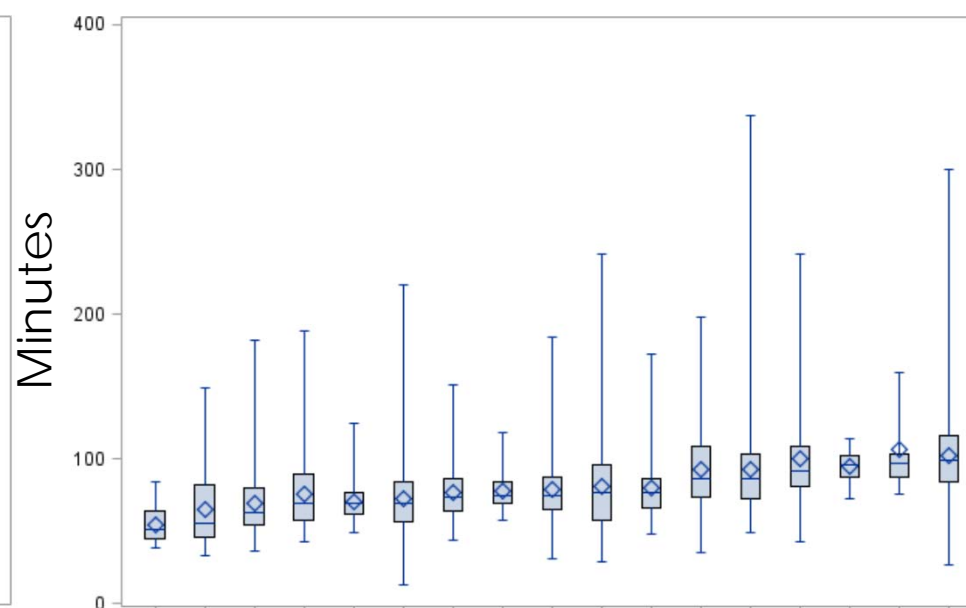


Hip



Hospital

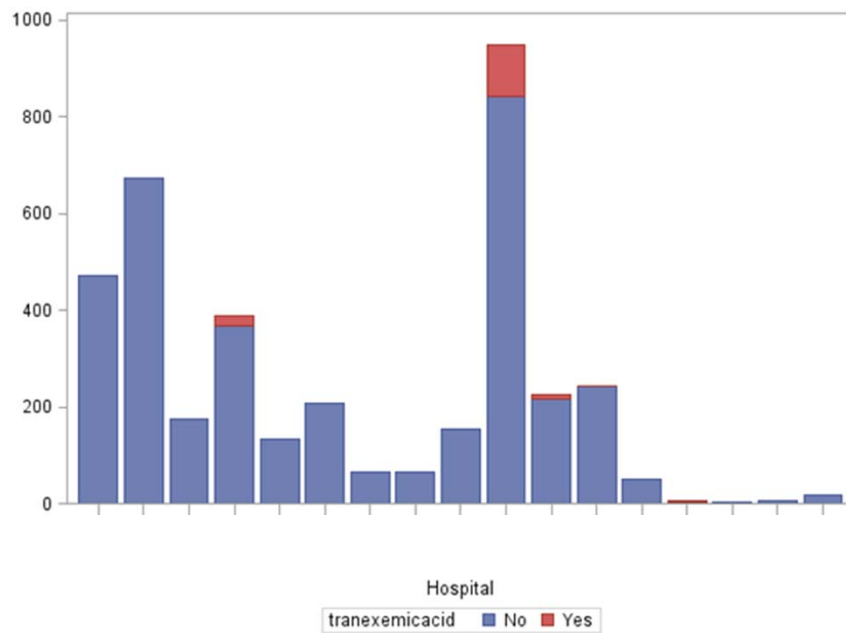
Knee



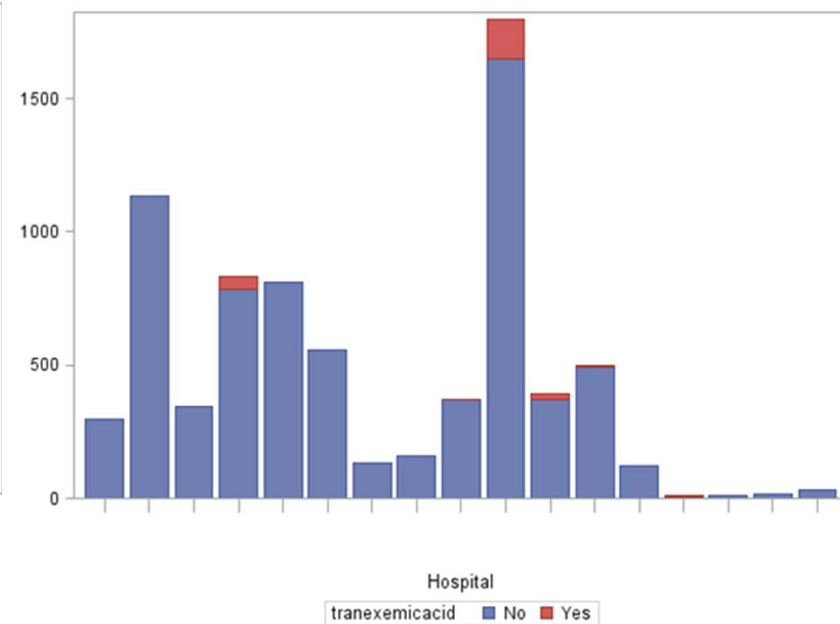
Hospital

Use of Tranexemic Acid

Hip



Knee



Associations of surgical variables with outcome for hip arthroplasty



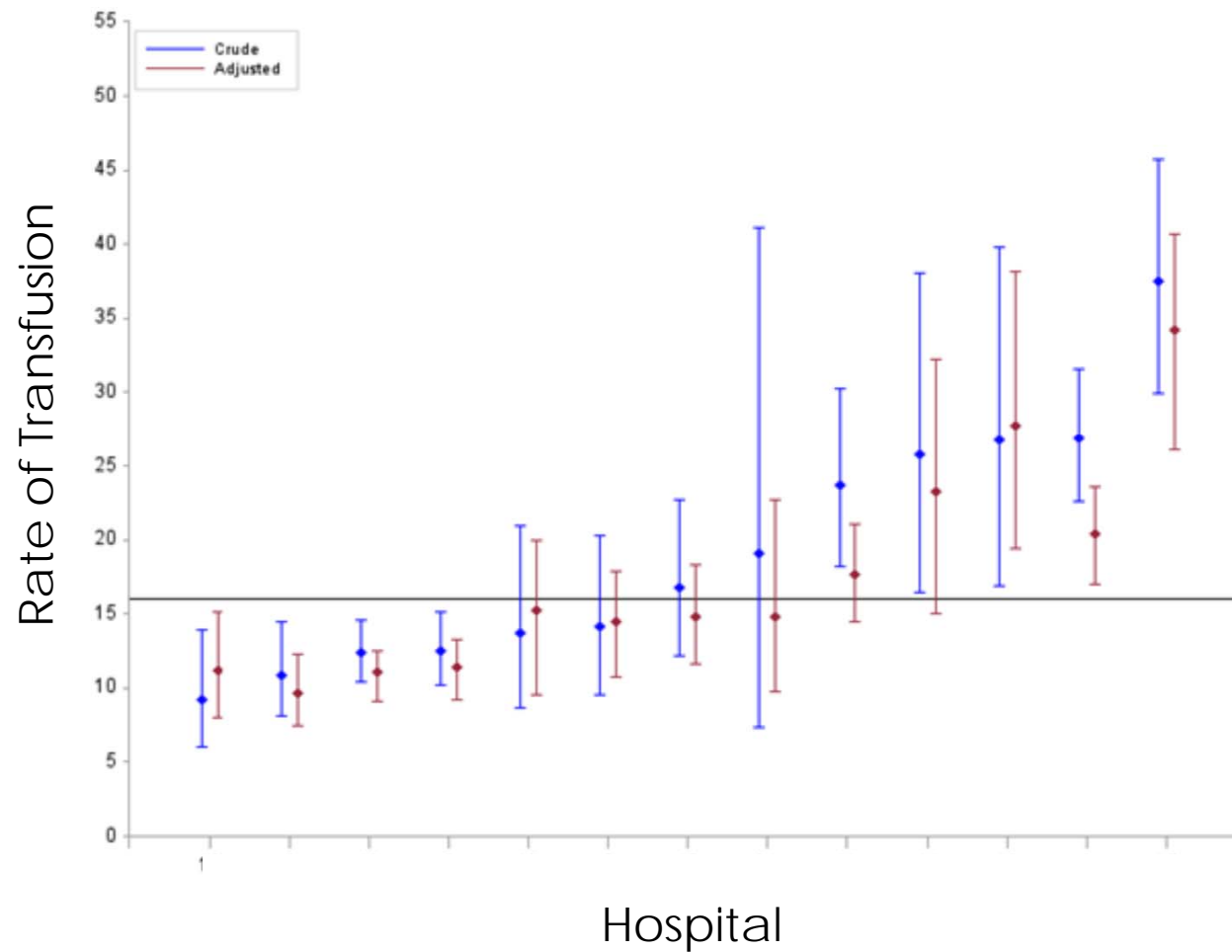
Variable	Blood Transfusion	Readmission
	RR (95% CI)	RR (95% CI)
Anesthesia General versus Regional	1.30 (0.92-1.86)	1.53 (1.18-1.97)
Operative Approach		
Anterolateral versus Posterior	1.52 (1.21-1.90) #	0.88 (0.67-1.14)
Anterior versus Posterior	0.82 (0.30-2.23)	1.22 (0.76-1.96)
Tranexemic Acid	0.64 (0.44-0.93)	1.10 (0.93-1.29)
15 Minutes of OR time		1.04 (0.97-1.11)
Blood Transfusion		1.20 (1.09-1.33)

Interpret with caution

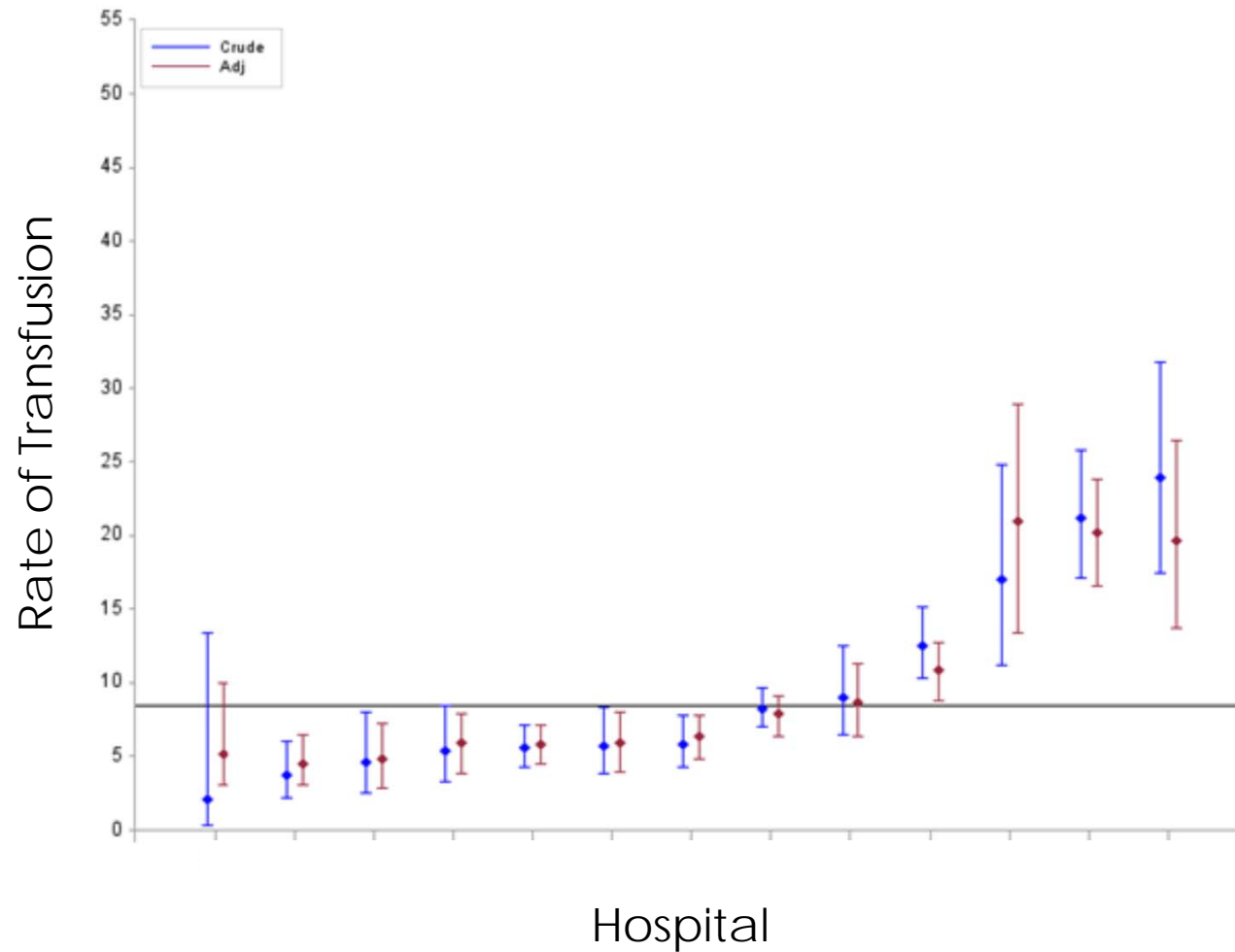
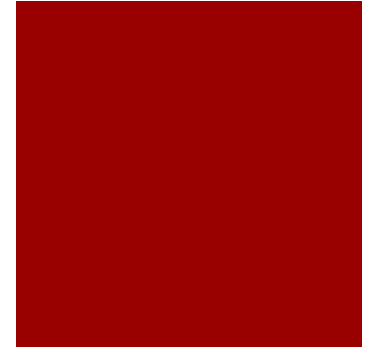
Associations of surgical variables with outcome for knee arthroplasty

Variable	Blood Transfusion	Readmission
	RR (95% CI)	RR (95% CI)
Anesthesia General versus Regional	1.38(1.03-1.84)	1.15 (0.83-1.61)
Operative Approach		
MPK vs SVK	1.12 (0.80-1.59)	1.02 (0.87-1.20)
MVK vs SVK	0.79 (0.61-1.02)	1.01 (0.87-1.17)
Tranexemic Acid	0.85 (0.58-1.25)	0.90 (0.72-1.11)
15 Minutes of OR time		1.11 (1.07-1.16)
Blood Transfusion		1.27 (1.08-1.50)

Crude and adjusted risk of blood transfusion for hip arthroplasty by MARCQI site



Crude and adjusted risk of blood transfusion for knee arthroplasty by MARCQI site





Allogenic Transfusion

- Risks
 - Disease transmission
 - Increased complication rates
 - Increased readmissions (MARCQI data)
 - Increased mortality



MARCQI Transfusion Data

- 9.8% of MARCQI patients are transfused
 - 14.2% of hips
 - 7% of knees
 - 23% of bilateral knees
- Only 1.5% of patients have nadir Hgb < 7 g/dL
- 4.6% receive TXA



MARCQI Sites: Transfusion Guidelines

- Wide range of transfusion triggers
- Some have no protocol
- Asymptomatic patient
 - Hgb < 7 g/dL to Hgb < 9 g/dL
- Symptomatic patients
 - Hgb < 7 g/dL to Hgb < 11 g/dL



U of M Transfusion Guidelines

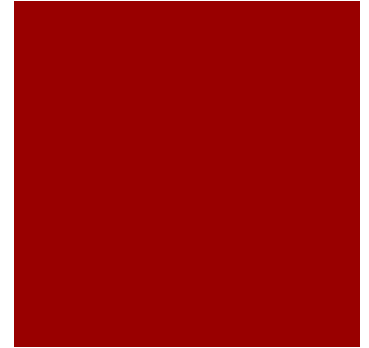
- Hgb < 6 g/dL in asymptomatic patient
- Hbg < 7 g/dL in post-op or ill patient
- Hgb < 10 g/dL acute coronary syndrome



Restrictive Transfusion Protocols

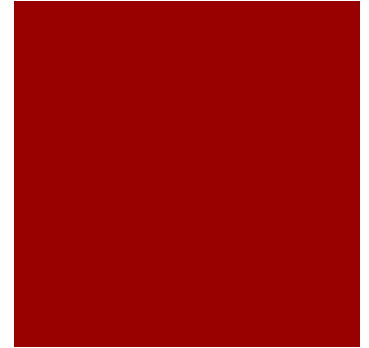
- Are safe
- Recommended by:
 - American Red Cross (ARC)
 - American Association of Blood Banks (AABB)
 - Cochrane Collaboration Review

Summary



- Transfusion may benefit patients during acute coronary syndromes if **Hgb < 8-10 g/dL**
- There is very rarely an indication to transfuse **ANY** patient with a **Hgb \geq 10 g/dL**
- **Each** unit incrementally increases risk
- Decreasing transfusion may
 - reduce risk of infection and readmission
 - reduce mortality
 - decrease cost

Guidelines for Blood Transfusion: PRBCs

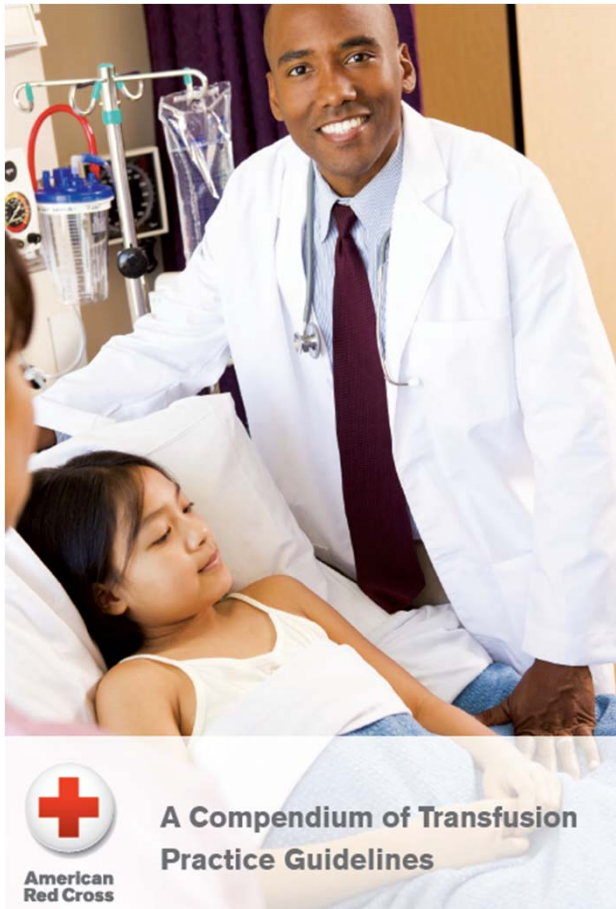


- These guidelines are intended to ensure that the most appropriate, efficient and safe use of the blood supply is achieved
- To establish evidence-based criteria for the transfusion of blood components
- Every indication for the use of blood products cannot be anticipated
- These guidelines are **not** intended to override physician judgement

Guidelines for Blood Transfusion: PRBCs

- Administered as **single units** except for ongoing blood loss with hemodynamic instability.
- Transfusion decisions are clinical judgments that should **not** be based on laboratory parameters alone.

Transfusion Guidelines



- Red Cross Transfusion Guidelines
 - Post-operative patients
 - Indications for allogenic transfusion
 - Threshold of Hgb < 8 g/dL
 - Clinically significant symptoms of anemia
 - Unresponsive to fluid resuscitation
 - Clinical judgement in patients with Hgb < 10 g/dL and increased risk factors



American
Red Cross

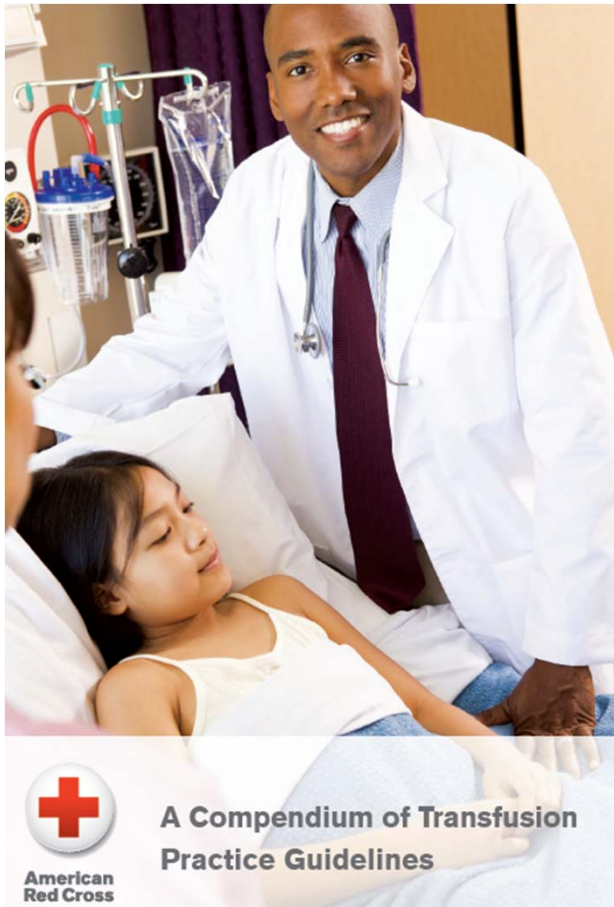
A Compendium of Transfusion
Practice Guidelines



MARCQI
MICHIGAN ARTHROPLASTY
REGISTRY
COLLABORATIVE QUALITY INITIATIVE



MARCQI recommendation



- Encourage adoption of the Red Cross Guidelines or similar protocols at your institution and in your practice
- Transfuse one unit at a time
- Encourage these practices with your colleagues



Tranexamic Acid

- Low numbers in MARCQI
- Associated with reduced transfusion in hips
- Concerns over risks
- Increasing support in literature
- Will continue to monitor

