



Transforming Patient Care Through  
**Patient Blood Management:**  
Shifting From Blood Utilization to Blood Health

**Gagan Mathur, MD, MBA, CPE**

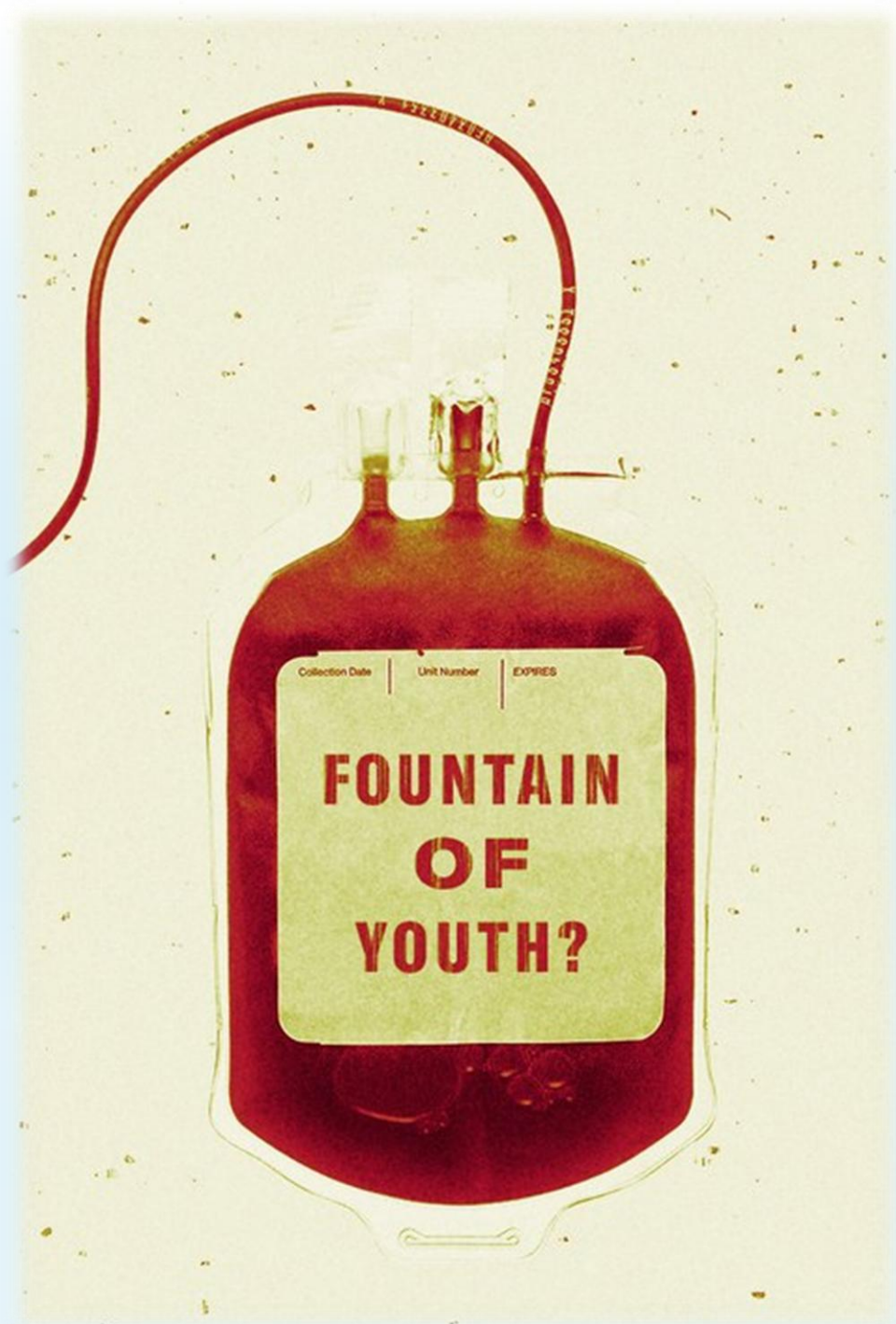
Medical Director, Transfusion Medicine  
University of California, Irvine

HAABB Spring Meeting

April 14, 2026

# Disclosure

- Financial: None
- Treasurer- Executive Committee, Society for the Advancement of Patient Blood Management (SABM)



# Blood Transfusions

- **Lifesaving** for patients experiencing hemorrhagic shock or hematologic malignancies.
- Enhances **quality of life** for anemic patients with diverse underlying health conditions.



- RBC transfusions are the most common hospital procedure in the U.S., with **~16 million blood components transfused annually**.
- They are also among the **most overused**, drawing scrutiny from The Joint Commission at the Overuse Summit.

Joint Commission. "Proceedings from the National Summit on Overuse." *National Summit on Overuse, Oakbrook Terrace, IL* (2012).  
The American National Red Cross (2024)

# Avoidable Transfusions



494 red blood cell transfusion studies were analyzed in 450 clinical scenarios; appropriateness deemed as improving health outcomes.

Shander, Aryeh, et al. "Appropriateness of allogeneic red blood cell transfusion: the international consensus conference on transfusion outcomes." *Transfusion medicine reviews* 25.3 (2011): 232-246.

Unnecessary transfusions expose patients to avoidable risks, **compromise patient safety and outcomes**, and increase the cost of care



Blood Transfusion is a  
Liquid Transplant

- **Infectious risks:** HIV, HBV, HCV, Sepsis, etc.
- **Non-infectious risks:** TACO, TRALI, Hemolysis, etc.
- **Immunomodulation:** Post operative infection/sepsis, Tumor progression, Deep vein thrombosis, Increased length of stay, etc.
- Blood is a limited resource

# Blood Utilization, review of transfusion practices to ensure judicious use of blood components



- Collect transfusion data
- Review transfusion practices
- Develop transfusion guidelines
- Educate and provide feedback to clinicians on appropriate transfusion practices

# Major Randomized Controlled Trials Comparing Restrictive and Liberal Transfusion Strategies

| Trial             | Population      | n    | Restrictive | Liberal      | Outcome            | Key Results                    |
|-------------------|-----------------|------|-------------|--------------|--------------------|--------------------------------|
| <b>TRICC</b>      | Critical care   | 838  | 7 g/dL      | 10 g/dL      | 30-day mortality   | 18.7% vs 23.3%, P=0.11         |
| <b>FOCUS</b>      | Hip fracture    | 2016 | 8 g/dL      | 10 g/dL      | Death/function     | 35.2% vs 34.7%, P=0.9          |
| <b>Villanueva</b> | GI bleeding     | 921  | 7 g/dL      | 9 g/dL       | Mortality          | 5% vs 9%, P=0.02               |
| <b>TRISS</b>      | Septic shock    | 998  | 7 g/dL      | 9 g/dL       | Mortality          | 43% vs 45%, P=0.44             |
| <b>TITRe2</b>     | Cardiac surgery | 2003 | 7.5 g/dL    | 9 g/dL       | Infection/ischemia | 35.1% vs 33.0%, P=0.3          |
| <b>TRICS-III</b>  | Cardiac surgery | 4860 | 7.5 g/dL    | 8.5–9.5 g/dL | Composite          | 11.4% vs 12.5%, noninferiority |

# Blood Utilization Focuses Primarily on **When and How Blood is Transfused!**

- Retrospective and reactive
- Overuse, wastage, and complications take center stage
- Primarily concerned with ensuring blood availability
- Minimal focus on preventing anemia or reducing blood loss



# Is Blood Utilization Effective? Is it Patient-Centric?

- Limited effectiveness due to inconsistent decision-making and **lack of preventive strategies.**
- Often **prioritizes blood usage** over individualized patient needs and outcomes.



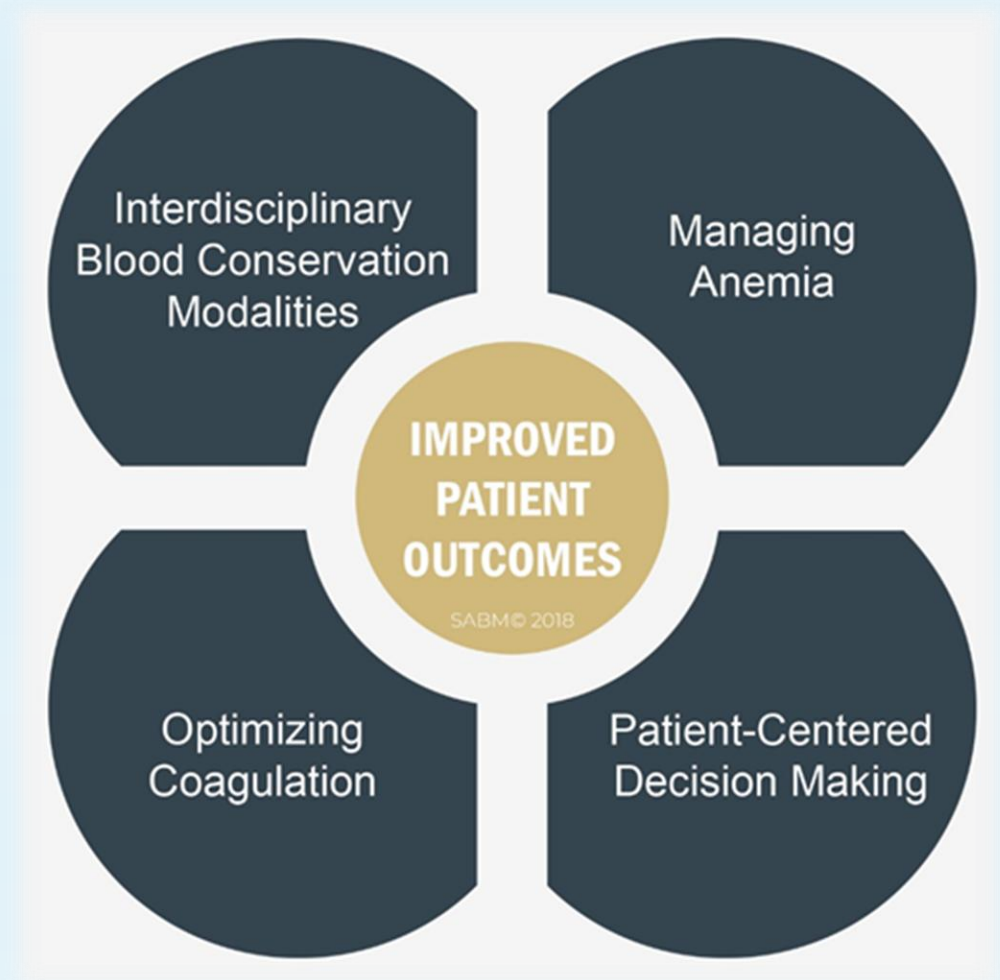
# Patient Blood Management

Patient Blood Management (PBM) is a patient-centered, systematic, evidence-based approach to improve patient outcomes by **managing and preserving the patient's own blood**, while promoting patient safety and empowerment.

Global Definition, Shander A. et al. Anesth Analg 2022; 135(3): 476-488

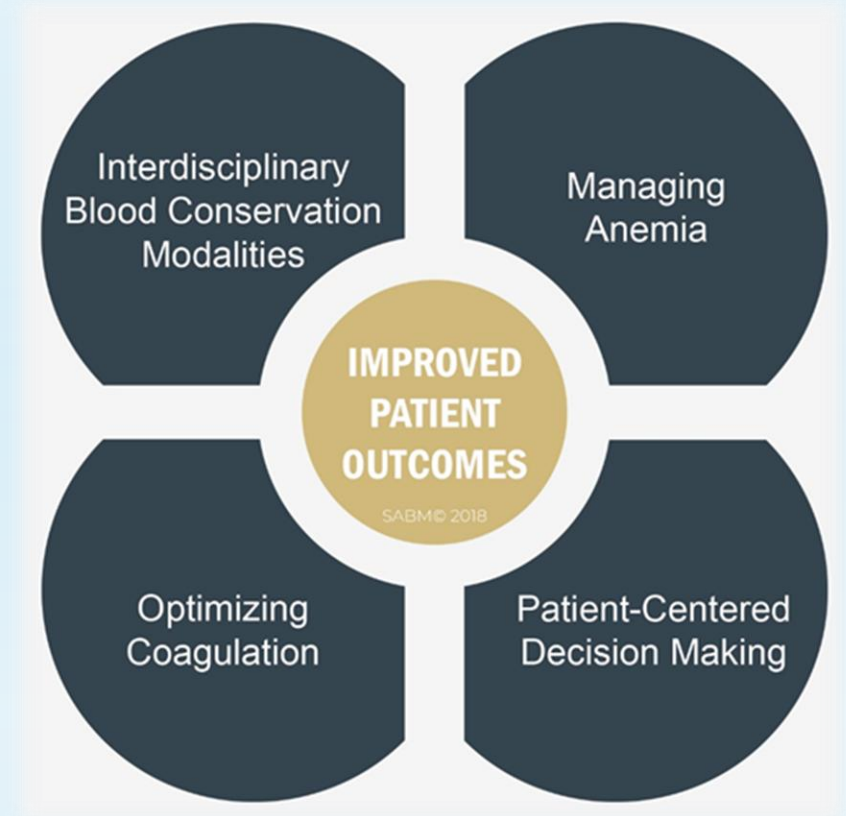
# Rely on the patient's own blood (Blood Health) rather than donor blood (Blood Utilization)

- PBM promotes evidence-based **medical and surgical concepts** to improve patient outcomes
- By managing & preserving **patient's own blood**



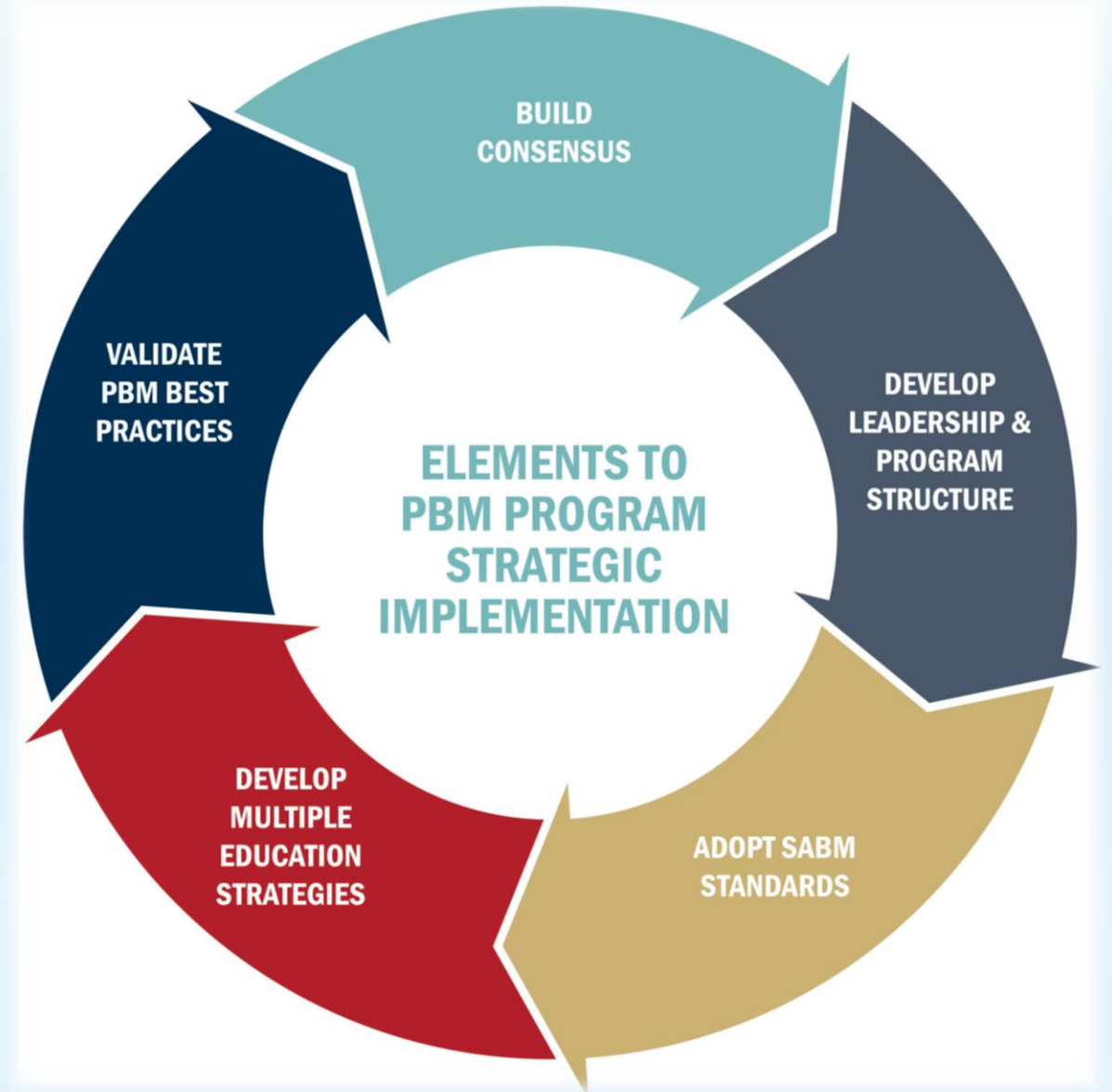
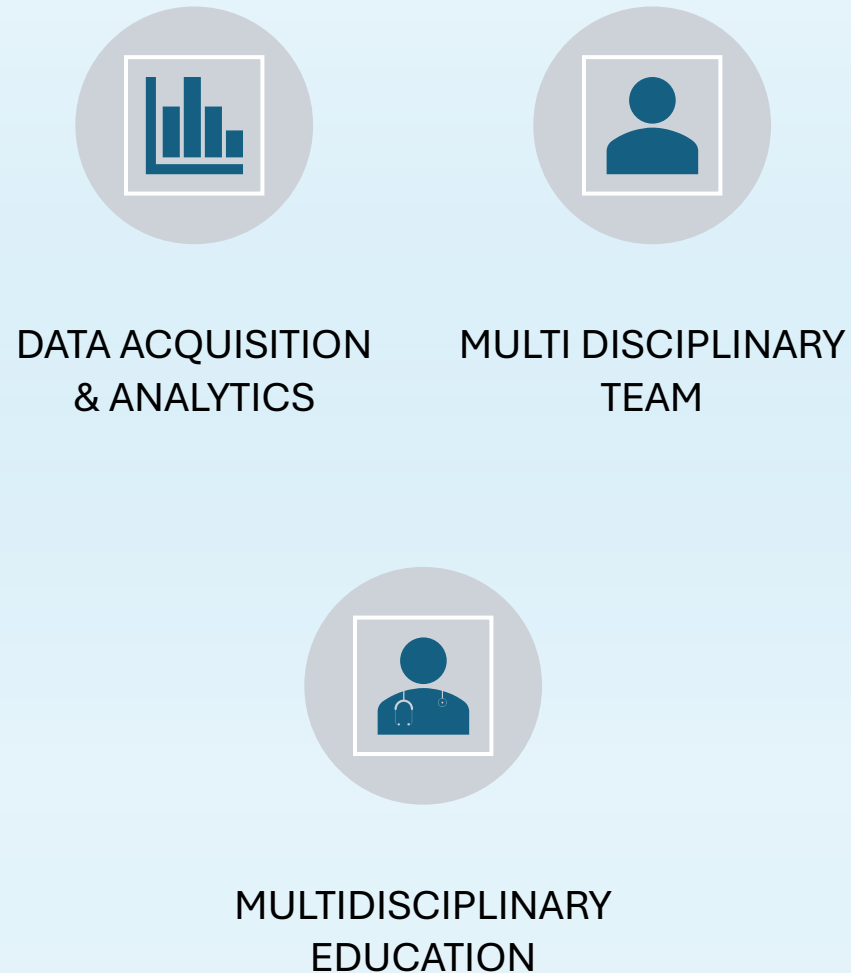
# PBM is Clinically Superior, Patient-Centered, and Fiscally Responsible

- Improves patient outcomes
  - Superior anemia management
  - Fewer complications
  - Decreased morbidity and mortality
- Reduces waste and costs
- Improves efficiency and quality
- Improves patient experience



Managing & preserving  
patient's own blood

# How to get started?



# PBM Initiatives

1. Minimizing Iatrogenic blood loss, batch labs, no rainbow draws, etc.
2. Meticulous surgical techniques, blood loss quantification n, POC tests, non-invasive Hb, etc.
3. Cell salvage, ANH, controlled hypotension, etc.
4. Tranexamic acid use
5. PAT, MSBOS, etc.

1. Evaluate coagulation status
2. Promote VET use for goal directed therapy
3. Transfusion guidelines compliance- Platelets, FFP, & Cryo
4. MTP protocol

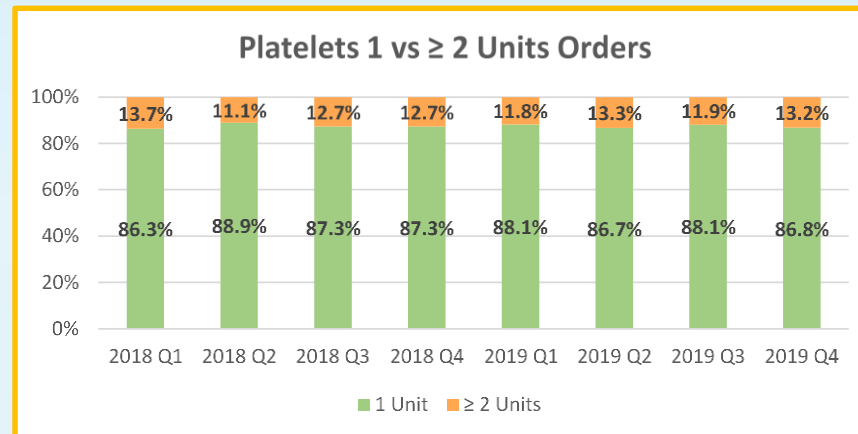
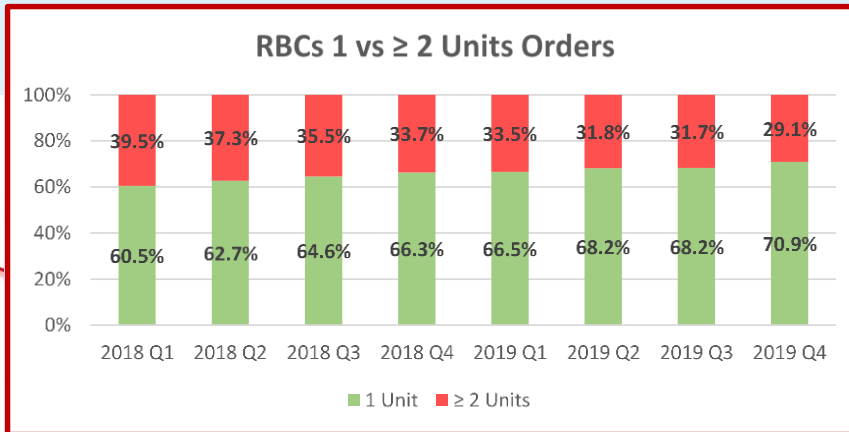


1. Anemia detection & workup
- 2. In-patient anemia management**
- 3. Pre-operative anemia management**
4. Transfusion guidelines compliance- RBC
5. Blood utilization review
- 6. Updated order-sets (1 unit only, CDS, etc.)**

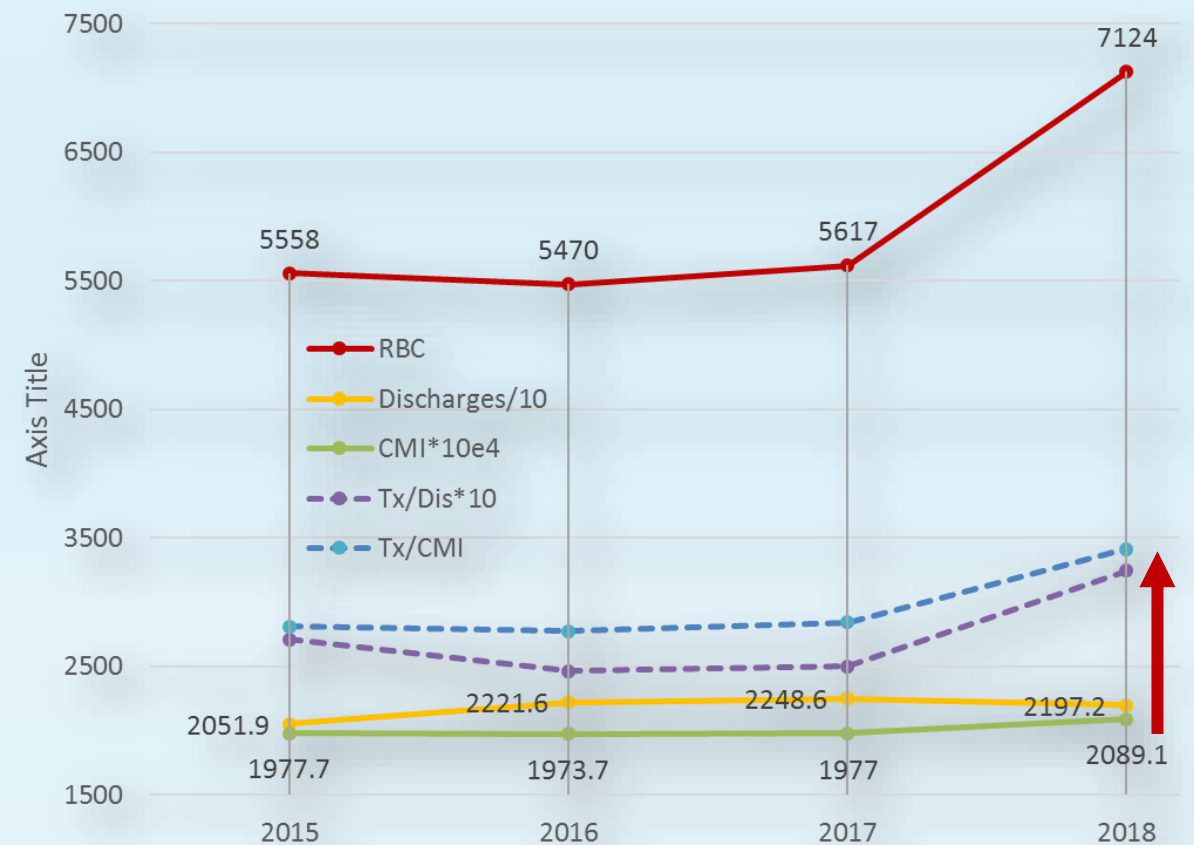
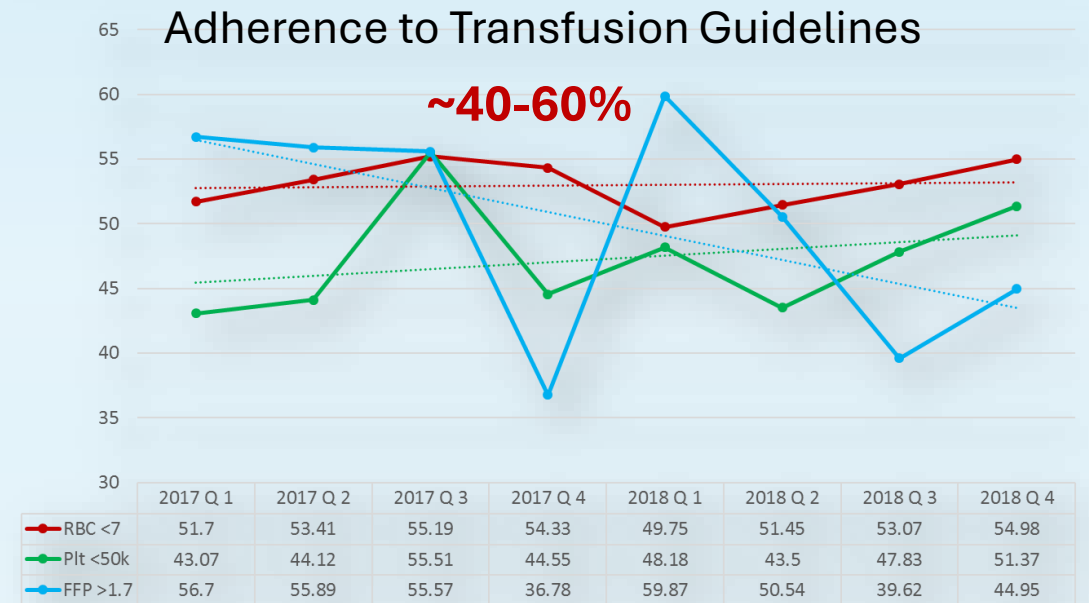
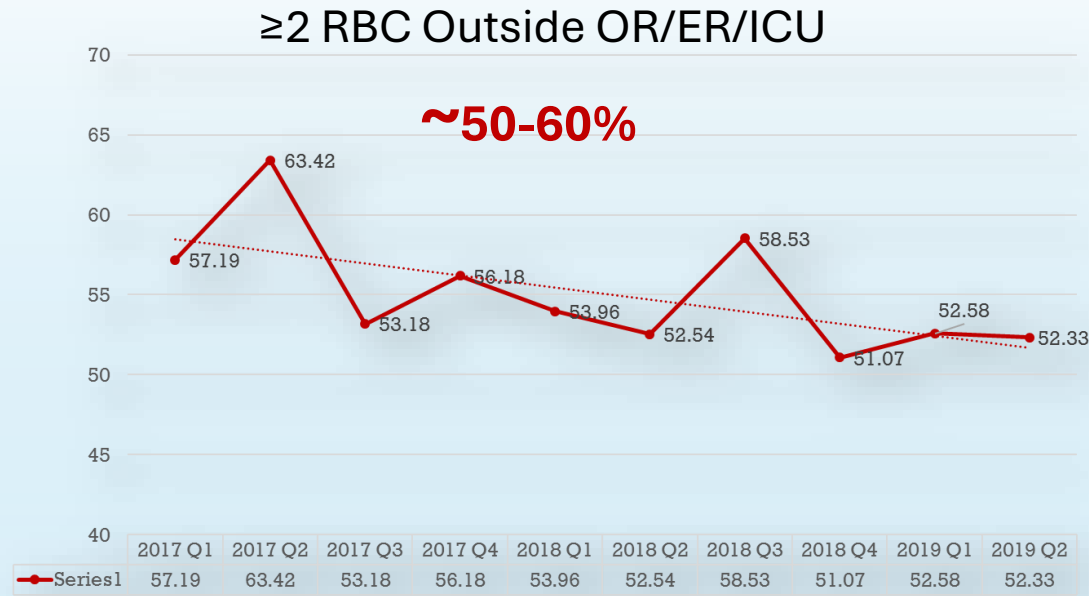
1. Patient & clinician education
2. Obtaining Informed "Choice" (Consent)
3. Reducing Specimen mislabeling errors
4. Improved transfusion reactions reporting

# Why Give 2, When 1 Will Do?

- Initiative to Reduce Avoidable Blood Transfusions
  - Encourage single-unit RBC and platelet transfusions for non-bleeding patients.
  - Aim to reduce  $\geq 2$  unit orders to **<15% for RBCs** and **<5% for platelets**.



# Blood Utilization



**Preoperative anemia** is associated with poor patient outcomes independent of blood transfusions, and poor outcomes are amplified in transfusion recipients

| Patients                    | Total                    | Transfused                          |
|-----------------------------|--------------------------|-------------------------------------|
| No Hb                       | 3321<br>(13.63%)         | 28 (0.11%, 136 units)               |
| No Anemia<br>(M >13, F >12) | 14423<br>(59.18%)        | 242 (1.68%, 670 units)              |
| Mild<br>(M 13/F 12-11)      | <b>3643<br/>(14.95%)</b> | <b>158 (4.34%,<br/>427 units)</b>   |
| Moderate<br>(11-8)          | <b>2776<br/>(11.39%)</b> | <b>365 (13.15%,<br/>1327 units)</b> |
| Severe<br>(<8)              | <b>207<br/>(0.85%)</b>   | <b>117 (56.52%,<br/>528 units)</b>  |
| <b>Total patients</b>       | <b>24370</b>             | <b>910 (3.73%,<br/>3104 units)</b>  |

|                          | Total cases | Total Anemic | % Anemic      |
|--------------------------|-------------|--------------|---------------|
| All                      | 24370       | <b>6626</b>  | <b>27.19%</b> |
| Cardiology               | 4624        | 1738         | <b>37.59%</b> |
| Gen surg                 | 5408        | 1117         | <b>20.65%</b> |
| GI                       | 1239        | 466          | <b>37.61%</b> |
| Ob-Gyn                   | 2608        | 868          | <b>33.28%</b> |
| Ortho                    | 5256        | 972          | <b>18.49%</b> |
| Urology                  | 2509        | 618          | <b>24.63%</b> |
| Vascular,<br>heart, etc. | 1389        | 609          | <b>43.84%</b> |

# Treatment of preoperative anemia is critical to health system **population health management and improving patient outcomes**

- Anemia Management Clinic can Improve Patient Outcomes, Decrease Complications, Save Cost & Even Generate New Revenue
  - **Generates revenue:** \$2,500–\$3,000 per iron infusion
  - **Reduces costs:** RBC unit acquisition ~\$200–\$250
  - **Achieves savings:** Up to \$2,000 per RBC unit through Activity-Based Costing (ABC)

# Inpatient Anemia, Not only are we failing to fix anemia, but we're making it worse!

Admission

| Count of PAT_ENC_CSN_ID              | Column Labels            | Discharge |                 |          |                |                |          |
|--------------------------------------|--------------------------|-----------|-----------------|----------|----------------|----------------|----------|
| Row Labels                           | Not Anemic               | Mild      | Moderate        | Severe   | No Value       | Grand Total    |          |
| Not Anemic                           | 60%                      | 23%       | 16%             | 1%       | 0%             | 100%           |          |
| Mild                                 | 6%                       | 46%       | 46%             | 2%       | 0%             | 100%           |          |
| Moderate                             | 1%                       | 5%        | 81%             | 13%      | 0%             | 100%           |          |
| Severe                               | 0%                       | 1%        | 52%             | 47%      | 0%             | 100%           |          |
| No Value                             | 0%                       | 0%        | 0%              | 0%       | 100%           | 100%           |          |
| Grand Total                          | 28%                      | 20%       | 35%             | 5%       | 12%            | 100%           |          |
|                                      | Same level of anemia     |           |                 |          |                |                |          |
|                                      | Improved level of anemia |           | Level of Anemia | # of pts | % At Admission | % At Discharge | # of pts |
|                                      | Worsened level of anemia |           | Not Anemic      | 22437    | 45%            | 28%            | 14184    |
| Anemia at Admission vs.<br>Discharge |                          |           | Mild            | 9645     | 19%            | 20%            | 10061    |
|                                      |                          |           | Moderate        | 10255    | 20%            | 35%            | 17435    |
|                                      |                          |           | Severe          | 2057     | 4%             | 5%             | 2714     |
|                                      |                          |           | No Value        | 5838     | 12%            | 12%            | 5838     |

# Diagnosis and Treatment of Root Cause of Anemia is Often Ignored, and Transfusion Used as the Default Treatment!

- ~50% of patients are anemic on admission (~25% moderate, ~5% severe)
- <20% had iron studies ordered
- <20% of severe IDA patients (Ferritin <30) received iron supplementation
- 95% of patients with Hb <7 g/dL are transfused
- 65-70% of patients are discharged anemic (~45% moderate, ~6% severe)

# 30-Day Readmission Rates and Length of Stay Increase with Anemia Severity.

## Anemia At Admission

| Level of Anemia    | # of pts     | Anemia %    | Avg LOS d  | Pts ReAd 30 d | Anemia %    | % of total | At Re Ad 30 d | Anemia %    | Avg LOS d  |
|--------------------|--------------|-------------|------------|---------------|-------------|------------|---------------|-------------|------------|
| Not Anemic         | 22437        | 45%         | 4.8        | 2214          | 38%         | 10%        | 1628          | 28%         | 4.6        |
| Mild               | 9645         | 19%         | 5.1        | 1237          | 21%         | 13%        | 1252          | 21%         | 5.5        |
| Moderate           | 10255        | 20%         | 5.9        | 1860          | 32%         | 18%        | 2320          | 39%         | 6.9        |
| Severe             | 2057         | 4%          | 6.7        | 490           | 8%          | 24%        | 618           | 10%         | 7.9        |
| No Value           | 5838         | 12%         | 1.9        | 99            | 2%          | 2%         | 82            | 1%          | 4.0        |
| <b>Grand Total</b> | <b>50232</b> | <b>100%</b> | <b>4.8</b> | <b>5900</b>   | <b>100%</b> | <b>12%</b> | <b>5900</b>   | <b>100%</b> | <b>6.0</b> |

## Anemia At Discharge

| Level of Anemia    | # of pts     | Anemia %    | Avg LOS d  | Pts ReAd 30 d | Anemia %    | % of total | At Re Ad 30 d | Anemia %    | Avg LOS d  |
|--------------------|--------------|-------------|------------|---------------|-------------|------------|---------------|-------------|------------|
| Not Anemic         | 14184        | 28%         | 4.2        | 1345          | 23%         | 9%         | 934           | 16%         | 4.6        |
| Mild               | 10061        | 20%         | 4.6        | 1141          | 19%         | 11%        | 1066          | 18%         | 5.2        |
| Moderate           | 17435        | 35%         | 5.9        | 2707          | 46%         | 16%        | 3079          | 52%         | 6.4        |
| Severe             | 2714         | 5%          | 7.8        | 608           | 10%         | 22%        | 739           | 13%         | 7.9        |
| No Value           | 5838         | 12%         | 1.9        | 99            | 2%          | 2%         | 82            | 1%          | 4.0        |
| <b>Grand Total</b> | <b>50232</b> | <b>100%</b> | <b>4.8</b> | <b>5900</b>   | <b>100%</b> | <b>12%</b> | <b>5900</b>   | <b>100%</b> | <b>6.0</b> |

# Order Set Changes

- PBM Committee's initiative to enhance patient outcomes by reducing avoidable blood transfusions.
- Key changes made to Standard Blood Transfusion Orders.
- These updates promote **single-unit RBC and platelet transfusions** for non-bleeding patients.

## Standard Blood Transfusion Orders, Epic 75

- 1 Unit RBC (*Cannot be changed*)
- 1 Unit Platelet (*Cannot be changed*)
- Plasma (*Provider selects # of units*)
- Cryoprecipitate (*Provider selects # of units*)
- Iron studies and Iron supplementation (*Optional*)

**Non-Actively  
Bleeding Patients**

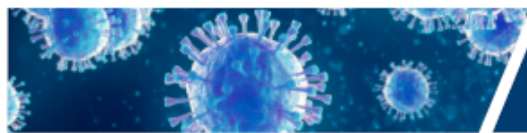
## Acute Hemorrhage Orders, Epic 2033

- 4 Units RBCs (*Default, provider can change*)
- 4 Units Plasma (*Default, provider can change*)
- Platelets (*Optional*)
- Cryoprecipitate (*Optional*)
- Tranexamic acid (*Optional*)

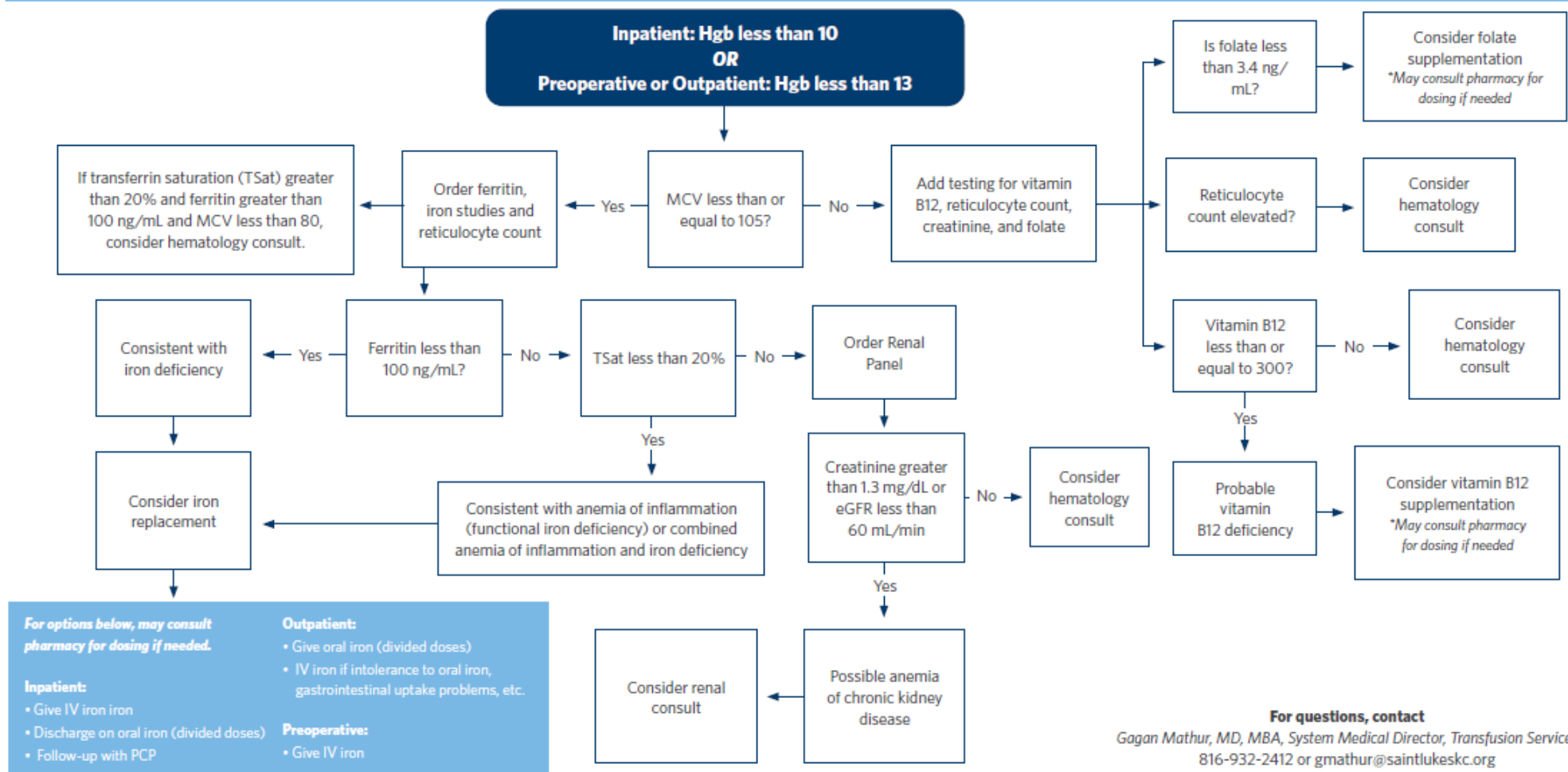
**Actively Bleeding  
Patients (Can be used  
for patients that need  
more than 1 unit)**

**SURGERY and ANESTHESIA:** Place the RBC - HOLD and GIVE for Surgery orders  
(Perioperative Staff to contact Blood Bank, if needed)

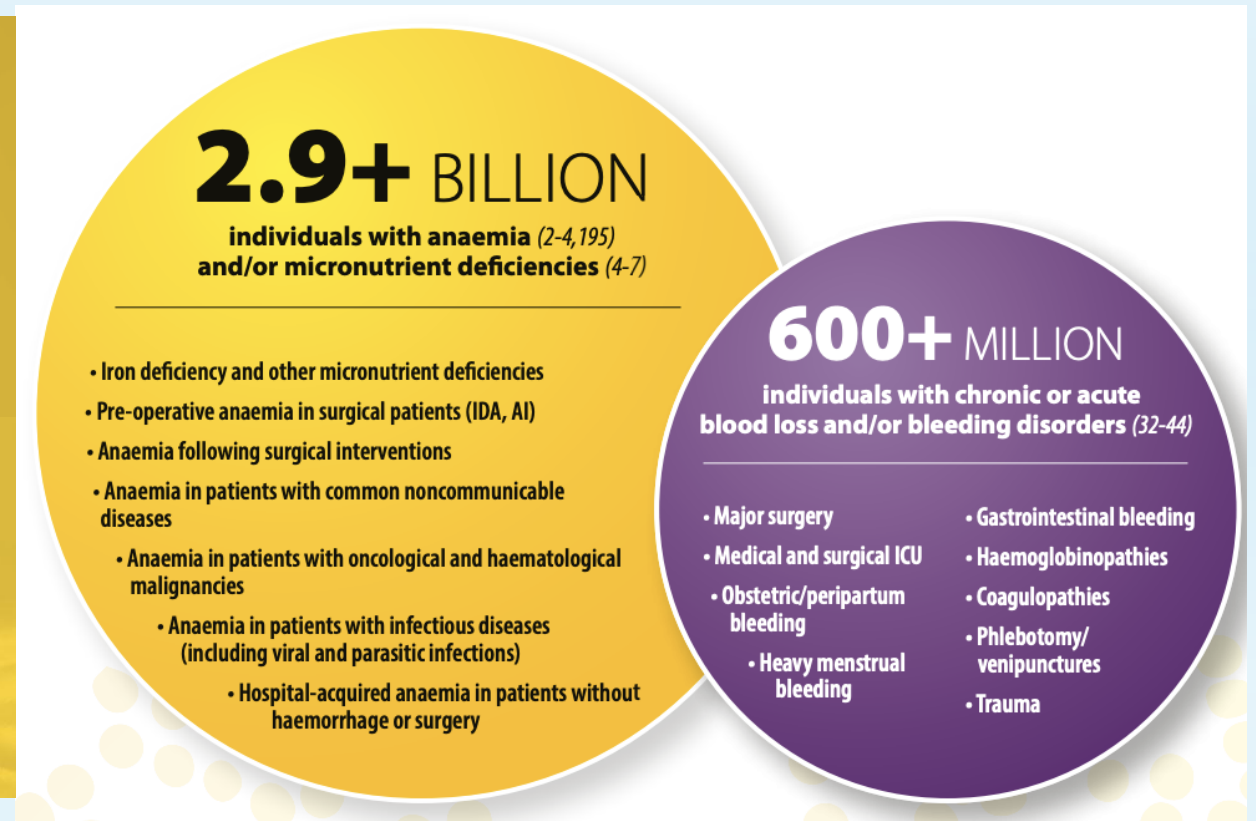
**Surgery/Anesthesia –  
HOLD and GIVE for  
Surgery orders**



# Anemia Management Algorithm



# Global Prevalence of Anemia





# *Anemia, A Silent Pandemic*

- Up to 50% of all patients with **SLE**. 30-70% in patients with *rheumatoid arthritis*<sup>1</sup>
- 30-80% in patients with *inflammatory bowel disease*<sup>2</sup>
- 30-50% in patients with *congestive heart failure*<sup>3</sup>
- 20-40% in *diabetics* w/o renal failure<sup>4</sup>
- 40-60% in patients with *chronic kidney disease*<sup>5</sup>
- 20–30% Anemia prevalence in **COPD**<sup>6</sup>
- 66% of women with **VWD** have heavy menstrual bleeding & 62% have low ferritin(IDA)<sup>7</sup>

# *Anemia & Cardiovascular Disease*



## **Atrial Fibrillation**

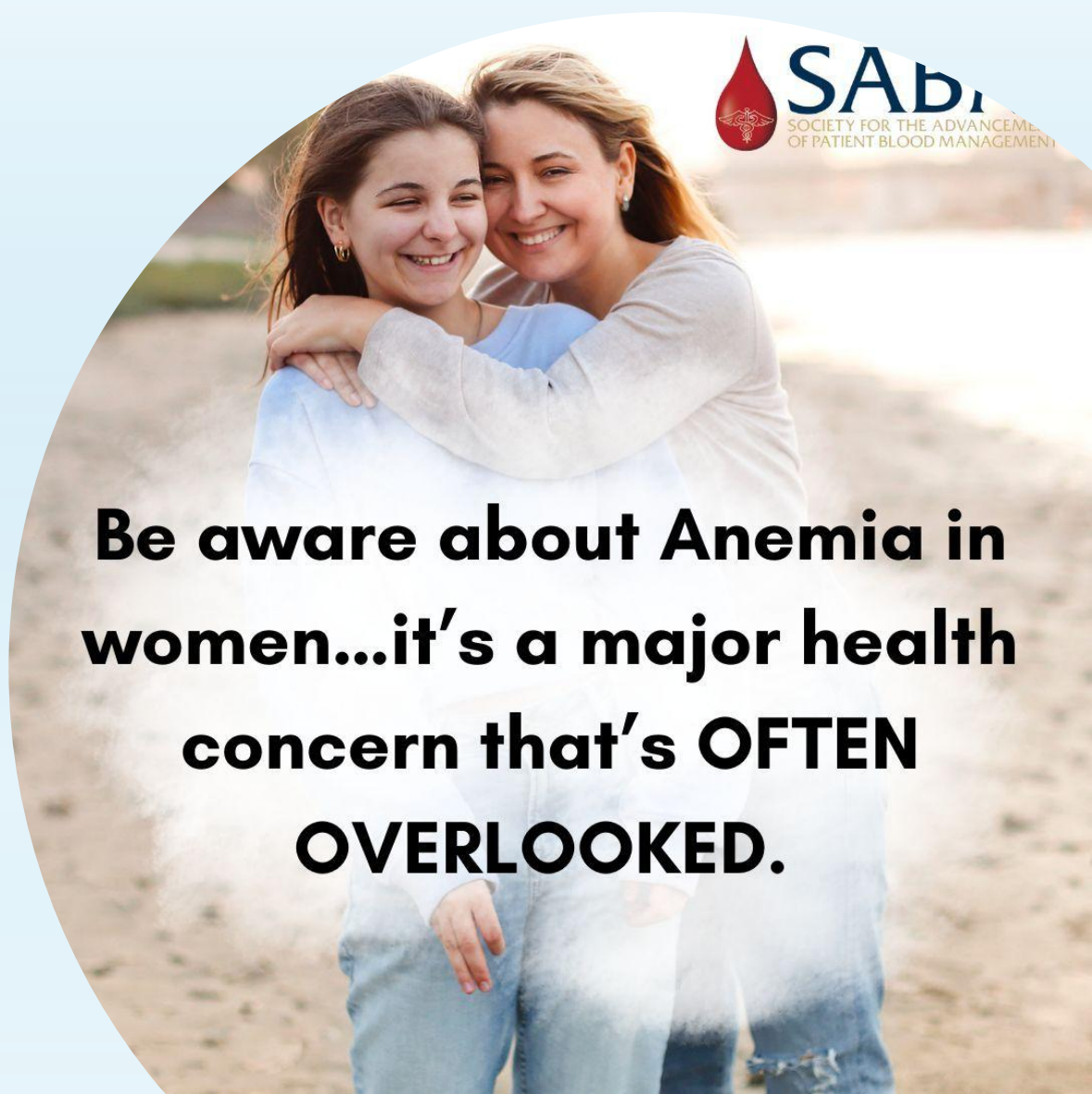
- *1 in 4 over age 40 develop Afib; 5-10% yearly growth in diagnosis*
- Anemia is associated with new-onset Afib
- Patients with anemia and Afib have **increased incidence of other cardiac events and mortality**

## **Heart Failure**

- 30-50% of chronic HF patients have iron deficiency, making it one of the most common HF comorbidities.
- Iron deficiency, with or without anemia, is associated with **poor exercise tolerance, worse functional status, higher hospitalization rates, decline in quality of life, and poorer prognosis**

# *Anemia in Women with Abnormal Uterine Bleeding*

- *Up to 60% prevalence of ID/IDA*
- *AUB is defined as bleeding which interferes with physical, emotional, social and material QOL*
- *Frequency of AUB over a lifetime is estimated to be as high as 50%, likely an underestimate.*
- *AUB accounts for 18-30% of all gynecologic visits in the U.S.*
- *Normalization of AUB in young girls and women has societal and cultural barriers to recognition and reporting.*



**Be aware about Anemia in women...it's a major health concern that's **OFTEN OVERLOOKED.****



## *Blood Health of mom affects overall health of baby*

- Nearly 30% of reproductive-age women worldwide are anemic.
- Anemia in pregnancy has a global prevalence of ~38%.
- Early pregnancy ID prevalence may reach 41%, rising to 81% later in gestation in some populations.
- Increased Risk for Mothers
  - Cesarean delivery, Preterm delivery, Perinatal bleeding, Transfusion, Placental abruption, Poor wound healing
- Increased Risk for Infants:
  - Poorer cognitive & social emotional development, LBW/SGA, Poor feeding, Poor motor skills

# Why Anemia Matters?

*Consequences of Anemia, patients are:*

- *2X more likely to develop hospital-acquired infections*
- *3X more likely to die*
- *4X more likely to develop AKI*
- *5X more likely to receive transfusions*
- *Increased 30-day readmission rates (odds ratio of 1.74, 2.76, & 3.47 for mild, moderate, or severe anemia, respectively)*

\*Fowler AJ et al. *Brit J Surg* 2015; 102: 1314-24

\*\*Koch C et al. *J Patient Safety* 2014; [www.journalpatientsafety.com](http://www.journalpatientsafety.com)

Gardner, William M., et al. "Prevalence, years lived with disability, and trends in anaemia burden by severity and cause, 1990–2021: findings from the Global Burden of Disease Study 2021." *The Lancet Haematology* 10.9 (2023): e713-e734.



**Preventable and treatable,  
yet anemia accounts for  
more years lived with  
disability (YLDs) than  
many high-profile chronic  
diseases**

# *Anemia, Accepted & Ignored*

PATIENT BLOOD  
MANAGEMENT  
AWARENESS WEEK®

## **ANEMIA** IS A LEADING GLOBAL HEALTH PROBLEM



ANEMIA AFFECTS ¼ OF  
THE GLOBAL  
POPULATION (1.92  
BILLION PERSONS),  
WITH A  
DISPROPORTIONATE  
BURDEN IN CHILDREN,  
WOMEN, AND THOSE  
RESIDING IN LOW-  
AND MIDDLE-INCOME  
COUNTRIES.



[WWW.SABM.ORG](http://WWW.SABM.ORG)



Anemia accepted as a  
harmless problem.



Diagnosing & treatment of  
root cause of anemia is often  
ignored.

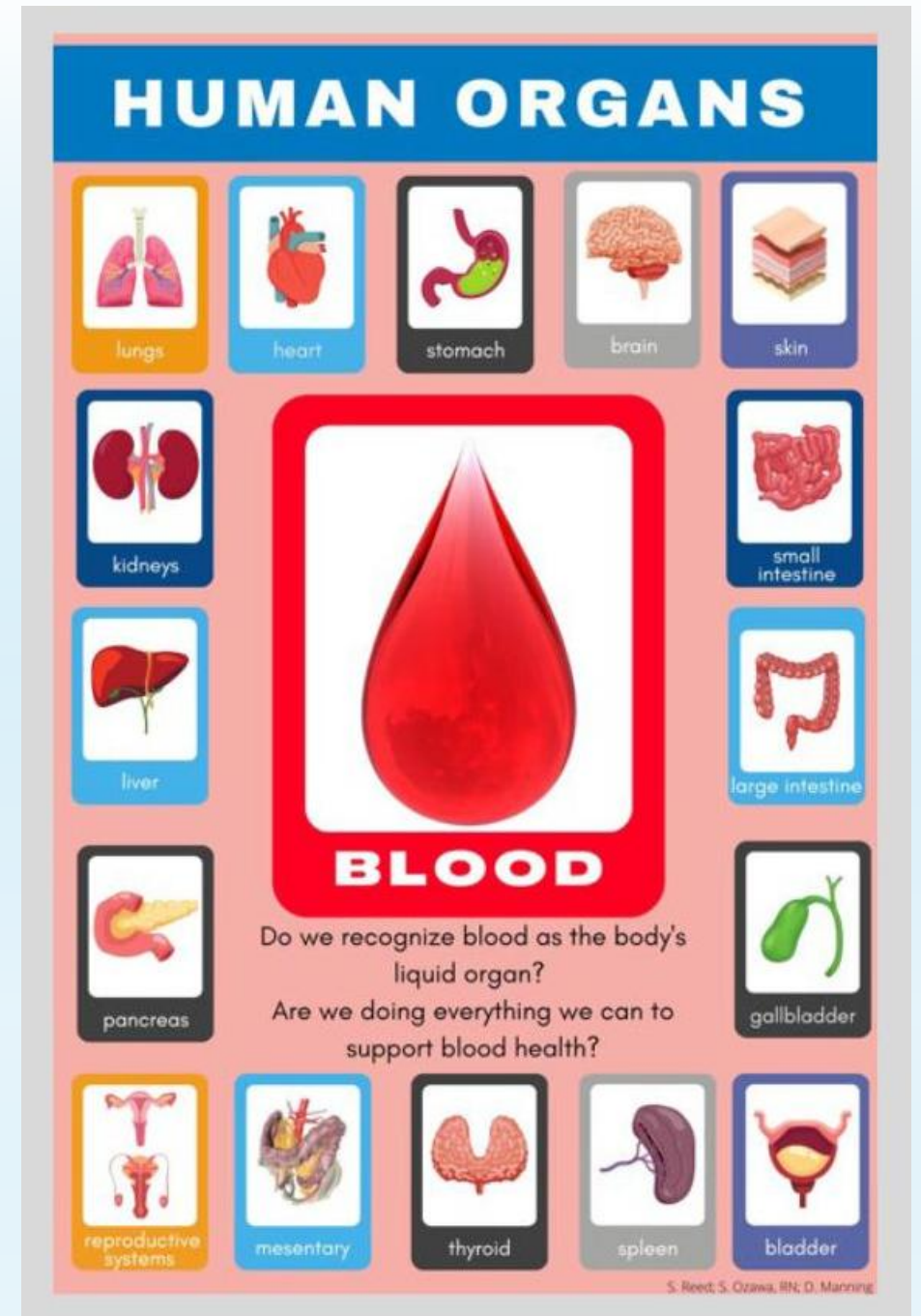


Transfusion is often used as  
default treatment.

# An Evolution: Blood Utilization → Patient Blood Management → Blood Health

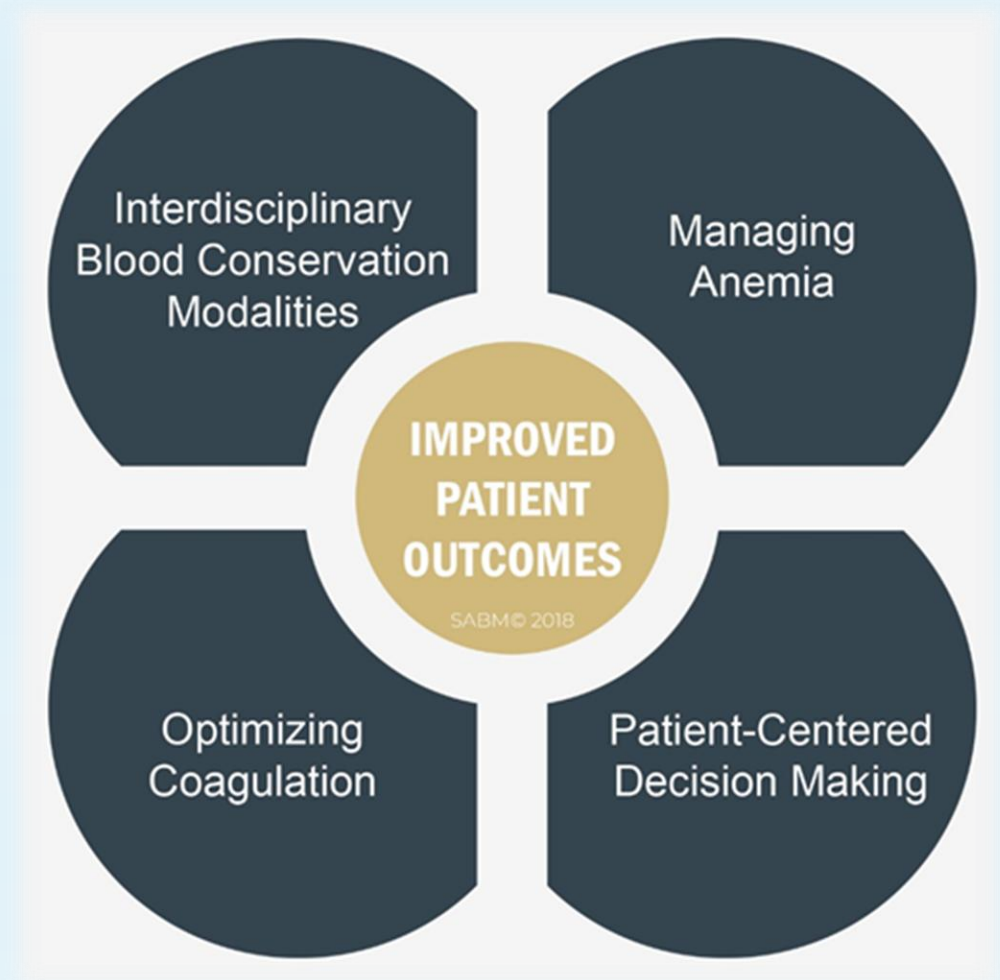
*Blood Health* is the  
*optimal function of individual  
elements of blood, and their  
associated interactions with  
all other organs and organ  
systems.*

Blood Health, Ozawa S, et al. Anesth Analg. 2025;141(5):950-955.



# *Blood Health* represents the evolution of *PBM*

- PBMs four pillars form the backbone of this approach.
- PBM & Blood Health should become the current standard of care.
- Integrating all aspects of PBM across the healthcare continuum for all patients.



# Goal

Protecting and  
Promoting *Blood  
Health*, and  
Preventing  
Disease Through  
*PBM*



# *Call to Action - Advocacy Priorities*

|           |                                                         |
|-----------|---------------------------------------------------------|
| Normalize | Normalize anemia screening in chronic disease care      |
| Recognize | Recognize iron deficiency even without anemia           |
| Embed     | Embed blood health into guidelines and policy           |
| Educate   | Educate patients and providers: fatigue is not “normal” |
| Support   | Support PBM as standard of care, not optional           |

SAVE  
THE  
DATE

# 2026 SABM ANNUAL MEETING

Atlanta Intercontinental, Atlanta, GA 📍 September 17-19, 2026



Questions,  
Comments,  
Concerns!

[www.SABM.org](http://www.SABM.org)