A NEW approach to Intraoperative blood transfusion preparation:

Using data as our guide

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OUTLINE

I. Background
   A. Decrease unnecessary Transfusion
   B. Optimize the preparation
II. Data- MGH and National
III. Strategy
IV. Case report
V. Impact
VI. Further Studies

nature International weekly journal of science

NATURE | NEWS FEATURE

Evidence-based medicine: Save blood, save lives

Transfusions are one of the most overused treatments in modern medicine, at a cost of billions of dollars. Researchers are working out how to cut back.

- Joint Commission
- Choosing Wisely
- #1 ranked journal in the world

Joint Commission Overuse Summit
(October, 2012)

Blood transfusion targeted at the Overuse Summit.

- **Blood transfusion is the most commonly performed procedure in US hospitals**

Five most overused procedures:

1. *Blood transfusions*
2. Heart vessel stents
3. Ear tubes
4. Antibiotics for the common cold
5. Early induction of labor without indication

S. Frank, MD (Johns Hopkins)

Eight Landmark Randomized Clinical Trials Supporting Hb Triggers of 7-8 g/dL (Less is More)

Randomized Trials:
– all supporting Hb triggers of 7 or 8 g/dL

- Carson JL, et al: NEJM 2011 – Elderly orthopedic surgery patients
- Hebert PC, et al: NEJM 1999 – Critically ill MICU patients
- Hajjar LA, et al: JAMA 2010 – Cardiac surgery patients
- Lacroix J, et al: NEJM 2007 – Critically ill PICU patients
- Villanueva C, et al: NEJM 2013 – Severe GI Bleeding
- Holst LB, et al: NEJM 2014 – Septic Shock
- Robertson CS. et al: JAMA 2014 – Traumatic Brain Injury
- Murphy GJ, et al: NEJM 2015 – Cardiac surgery patients

Courtesy of Steve Frank, MD

Three Categories of Risks / Adverse Effects from Blood Transfusion

Clinical Event		Risk / Unit
Allergic/Urticaria		1 in 100
RBC Alloimmunization		1 in 100
TACO		1 in 100
TRALI		1 in 5,000
Hemolytic Rxn		1 in 6,000
Wrong Unit Given		1 in 15,000
Hepatitis B		1 in 200,000
Hepatitis C		1 in 2,000,000
HIV 1 and HIV 2		1 in 2,000,000

} Common

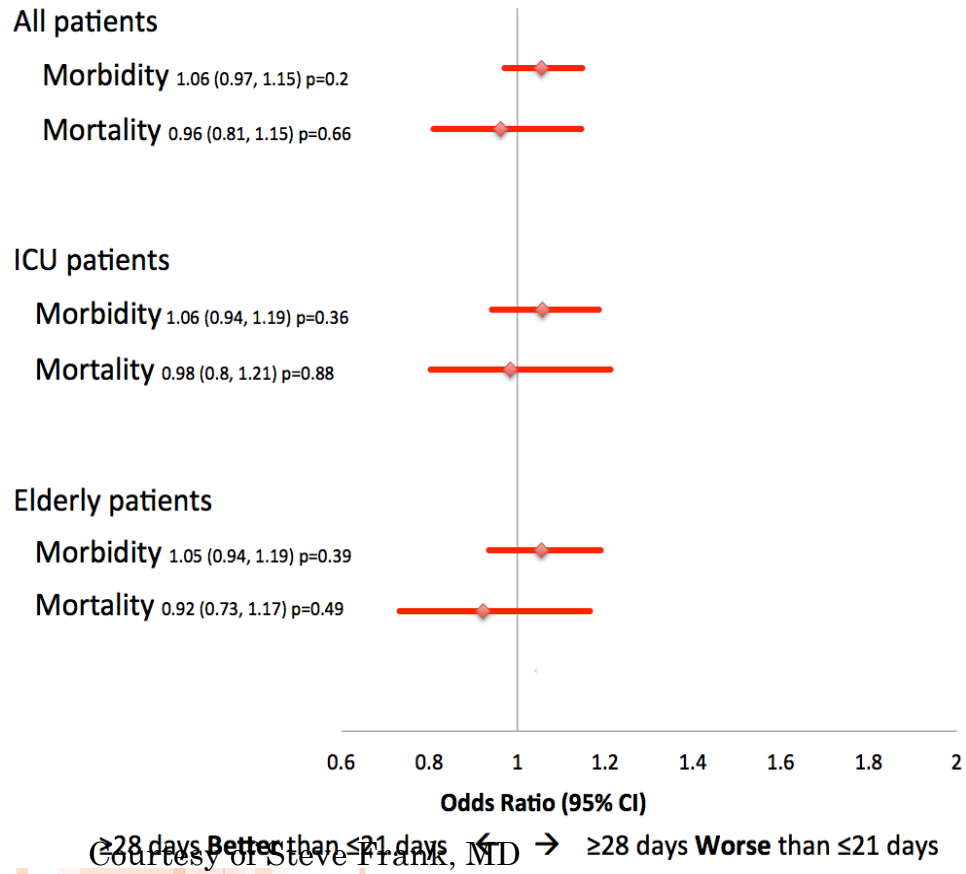
} Not so Rare

} Rare

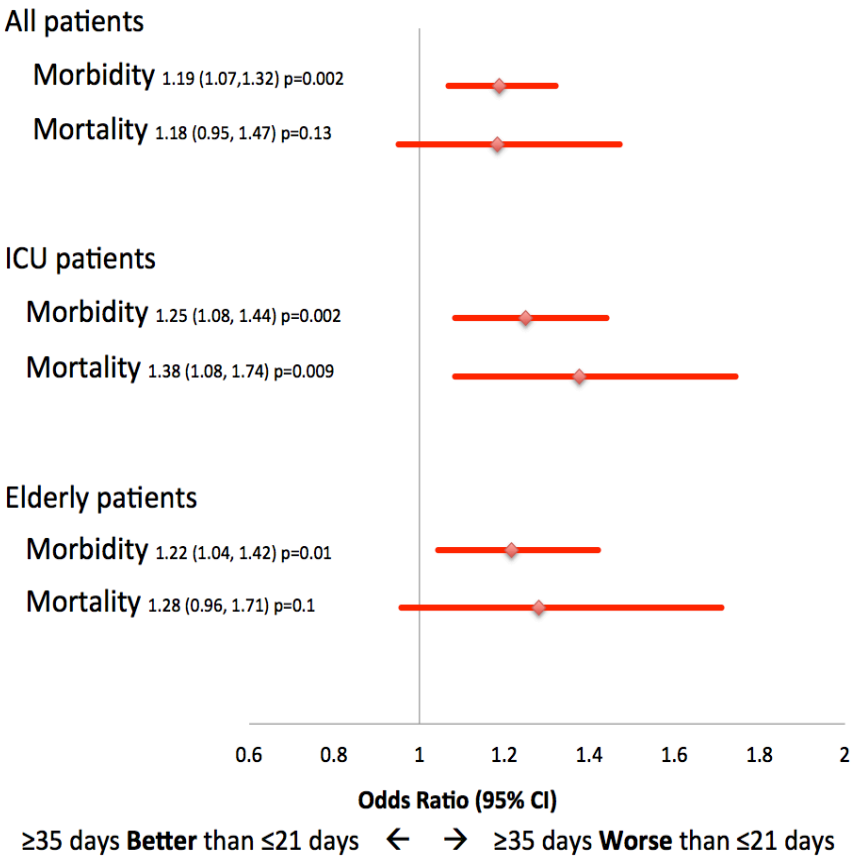
Red Blood Cells Stored ≥35 Days are Associated with Adverse Outcomes in High-risk Patients

(Goel R, *et al*, *Transfusion* 2016)

≥28 days



≥35 days



Courtesy of Steve Frank, MD

Frank SM, et al. Variability in blood and blood component utilization as assessed by an anesthesia information management system. Anesthesiology 2012;117:99-106

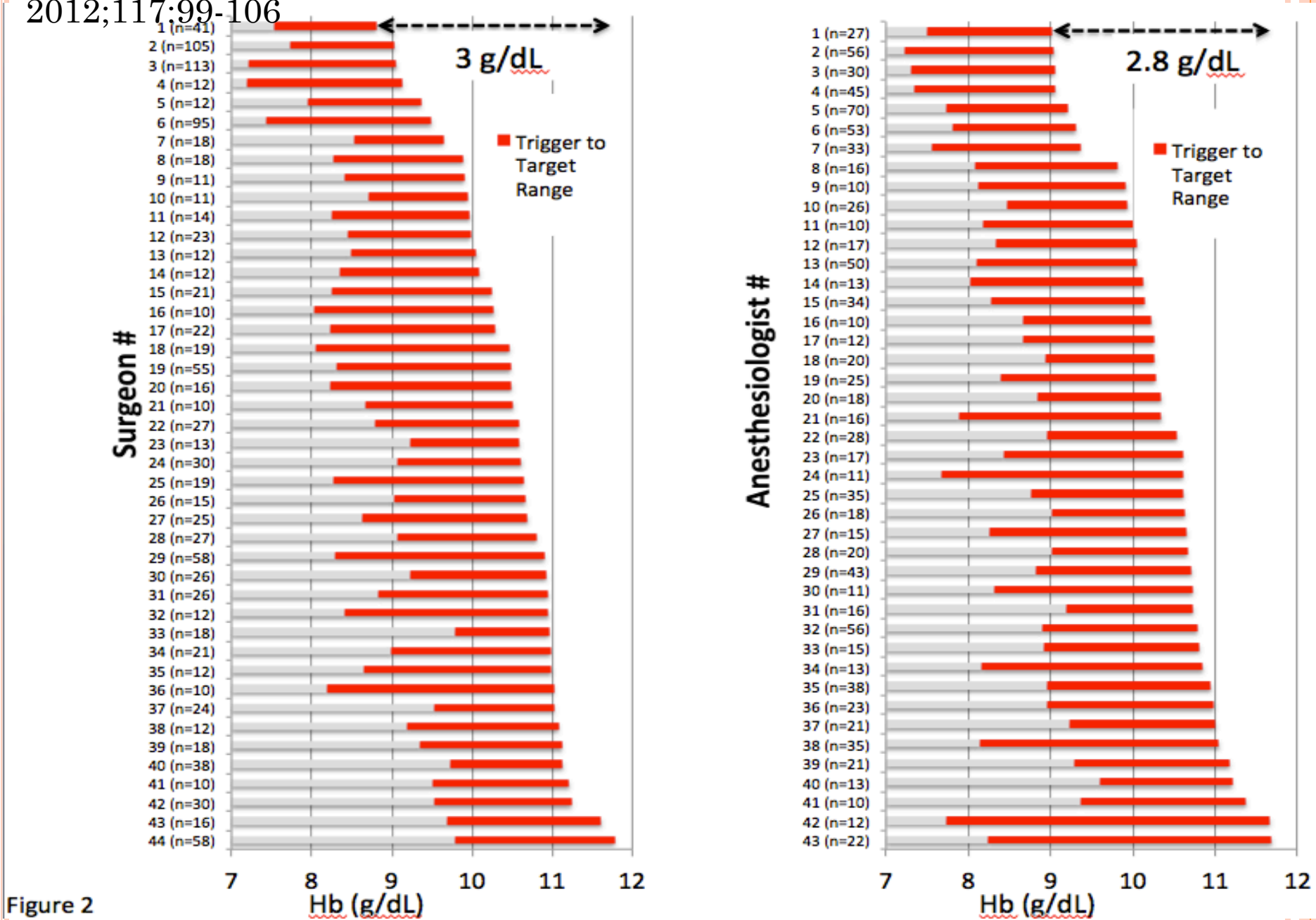
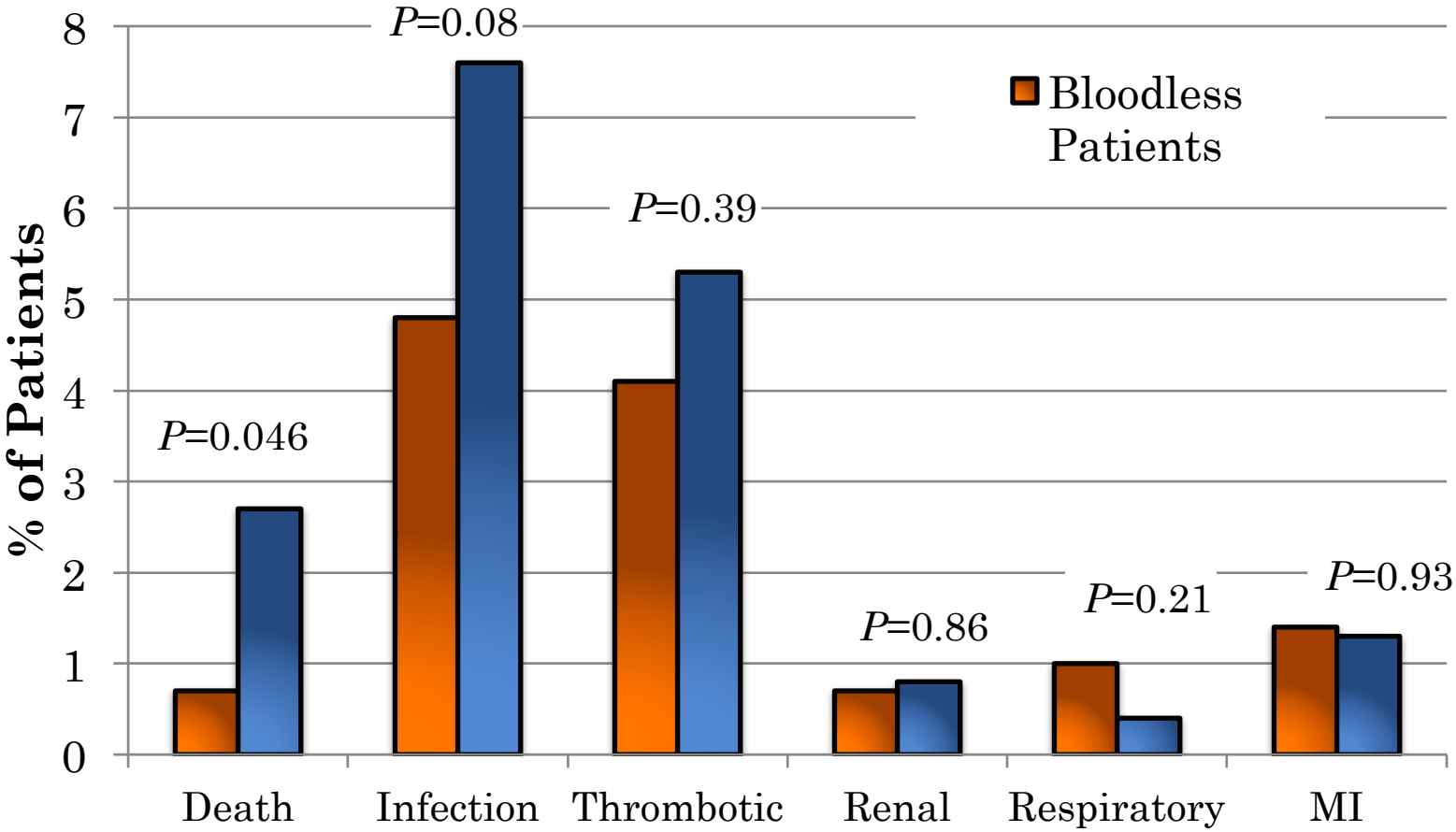


Figure 2

Risk-adjusted Clinical Outcomes in Patients Enrolled in a Bloodless Program

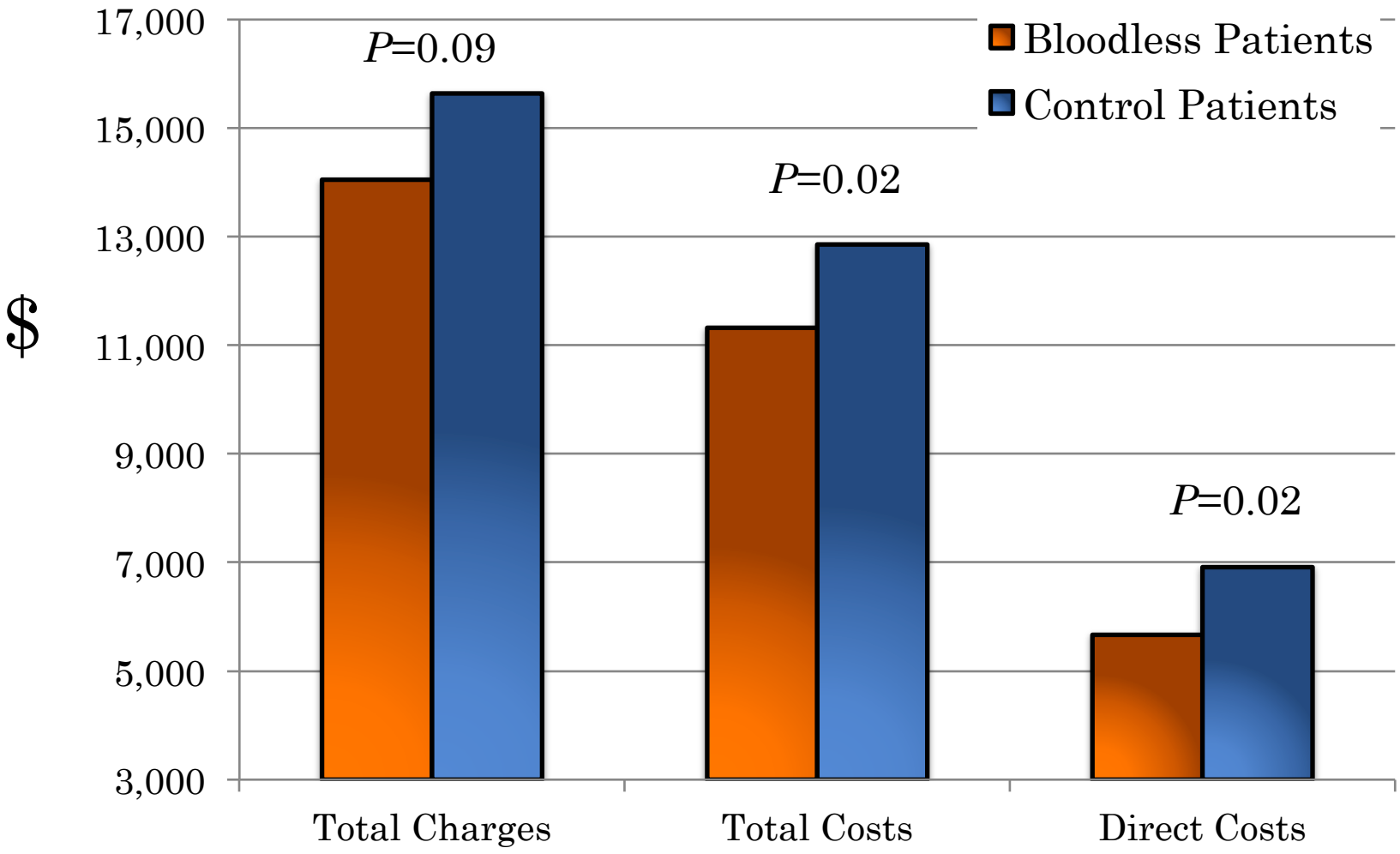
Frank SM, et al *Transfusion*, 2014

294 Jehovah's Witness Patients vs. Propensity Matched Controls



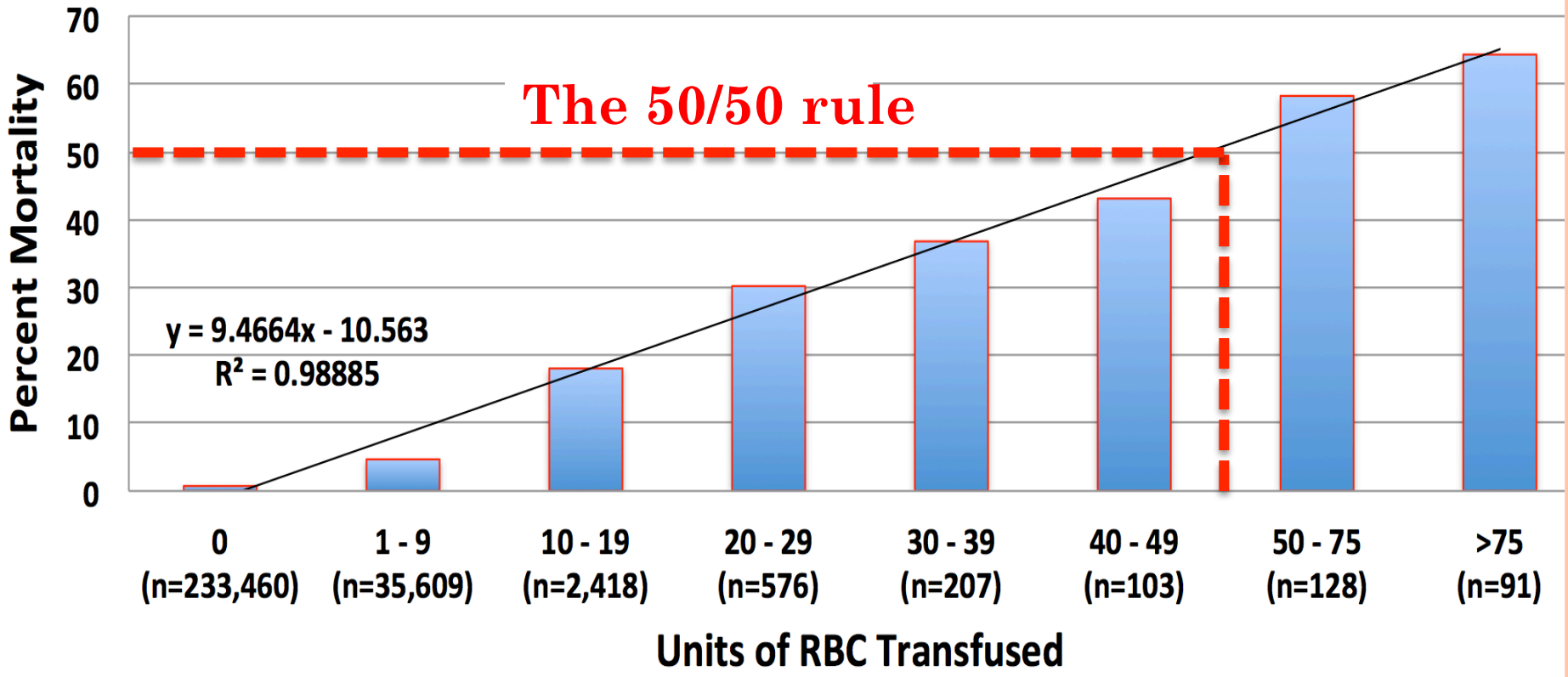
Risk-adjusted Clinical Outcomes in Patients Enrolled in a Bloodless Program

Frank SM, et al *Transfusion*, 2014



Morbidity and Mortality after High-dose Transfusion

Daniel J. Johnson, B.S., Andrew V. Scott, B.S., Viachaslau M. Barodka, M.D., Sunhee Park, M.D., Jack O. Wasey, B.M., B.Ch., Paul M. Ness, M.D., Tom Gniadek, M.D., Ph.D., Steven M. Frank, M.D.



Johnson DJ et al. *Anesthesiology*, 201

Choosing Wisely®

An initiative of the ABIM Foundation

5 Societies have aims to Reduce unnecessary transfusion

Society of Critical Care Medicine

American Society of Anesthesiologists

American Society of Hospital Medicine

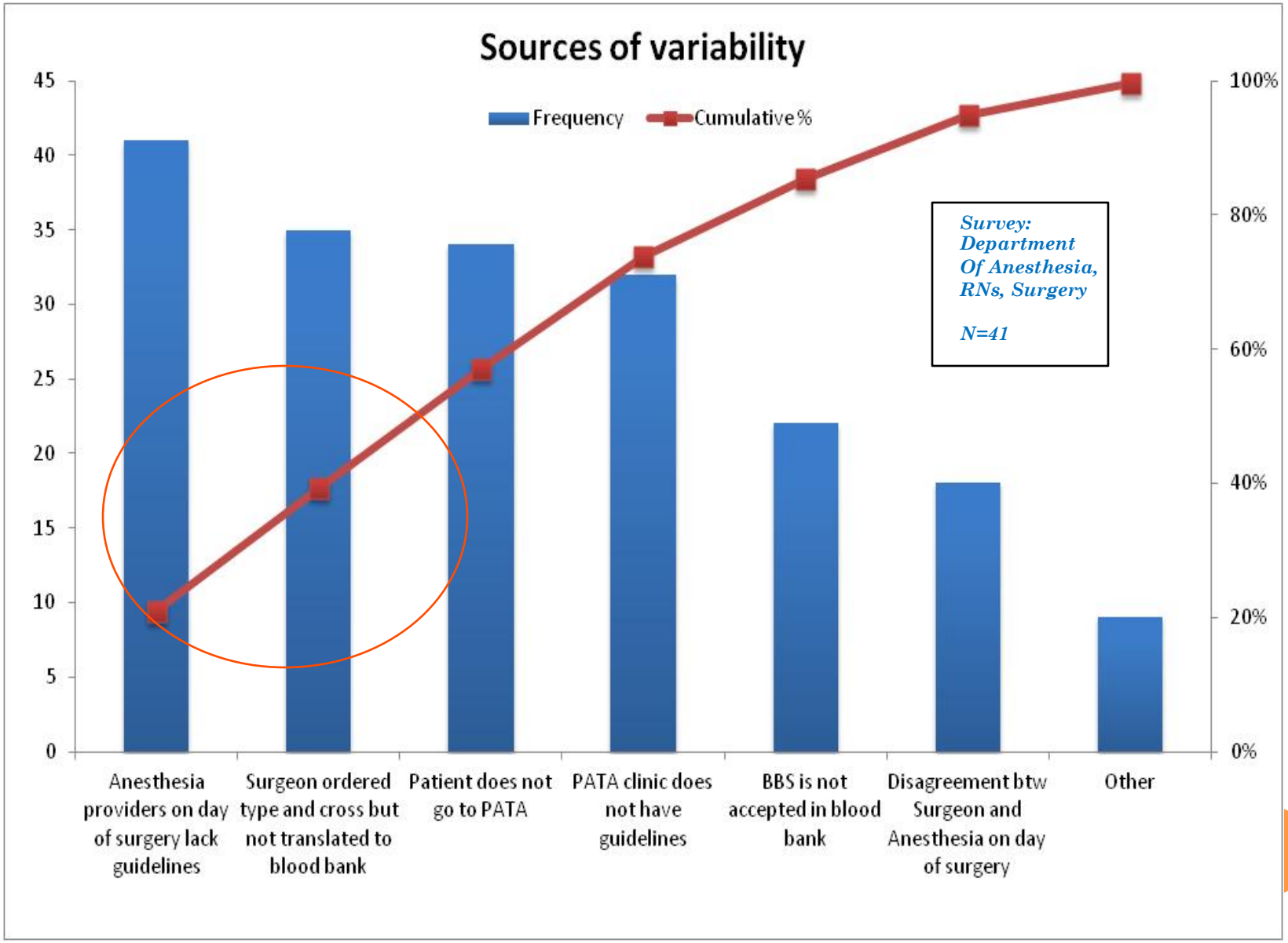
American Society of Hematology

American Association of Blood Banks

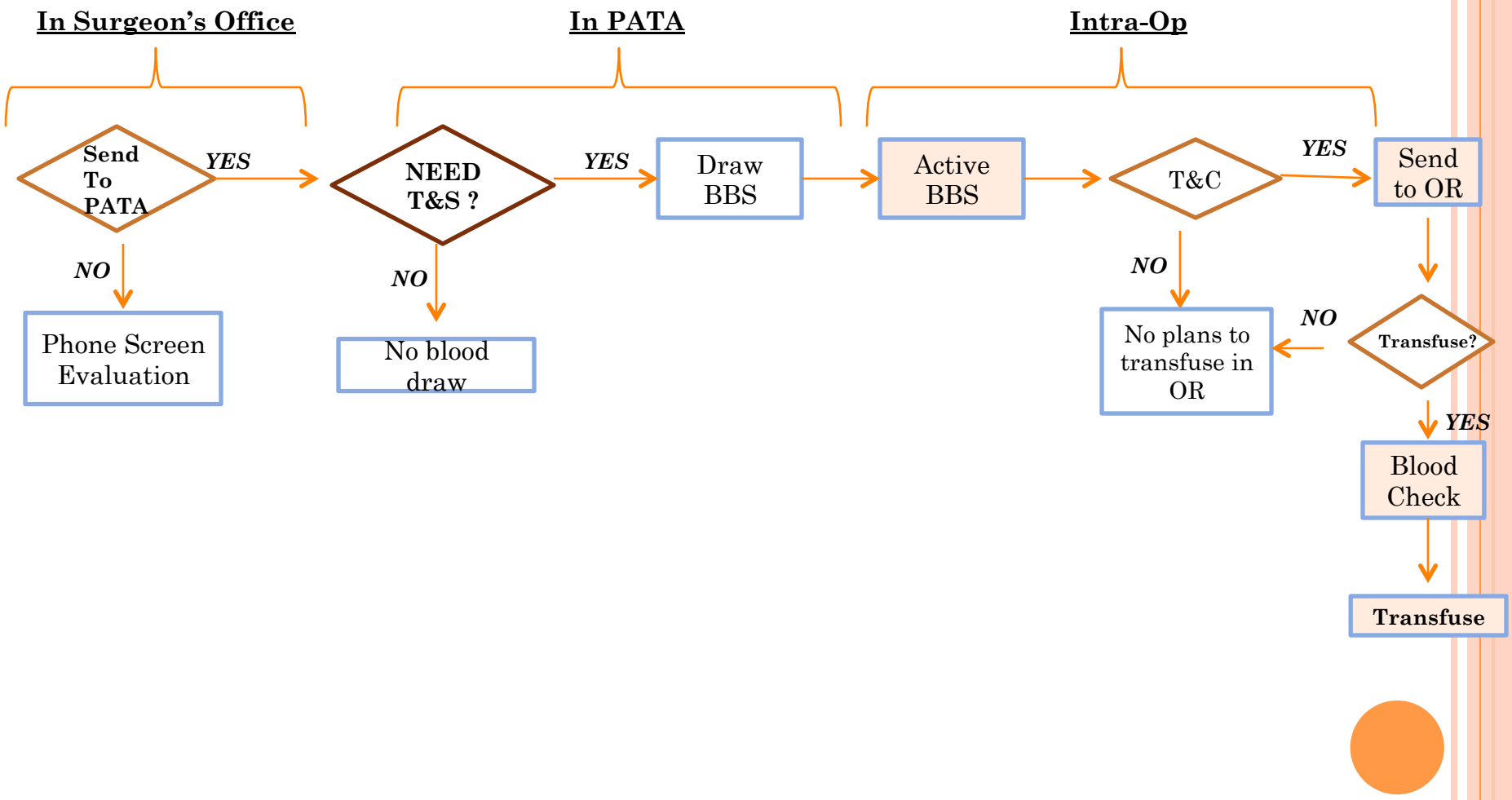
PROCESSES AROUND BLOOD PREPARATION

1. Explaining transfusion risk and obtaining informed consent
2. Pre-transfusion examination & clerical routine
3. Phlebotomizing & delivering patient's blood specimen to blood bank & central lab
4. Patient blood testing in central lab & analyzing results - routine & emergency
5. Controlling & storing components in hospital blood bank
6. ABO/Rh-typing new patients
7. ABO/Rh-typing control
8. Antibody screening
9. Cross matching manual distribution of components and controlling delivery received at transfusion site
10. Return deliveries of unused components
11. Cleaning transfusion site & disposing waste
12. Administering and monitoring transfusion

Diagnostic Data

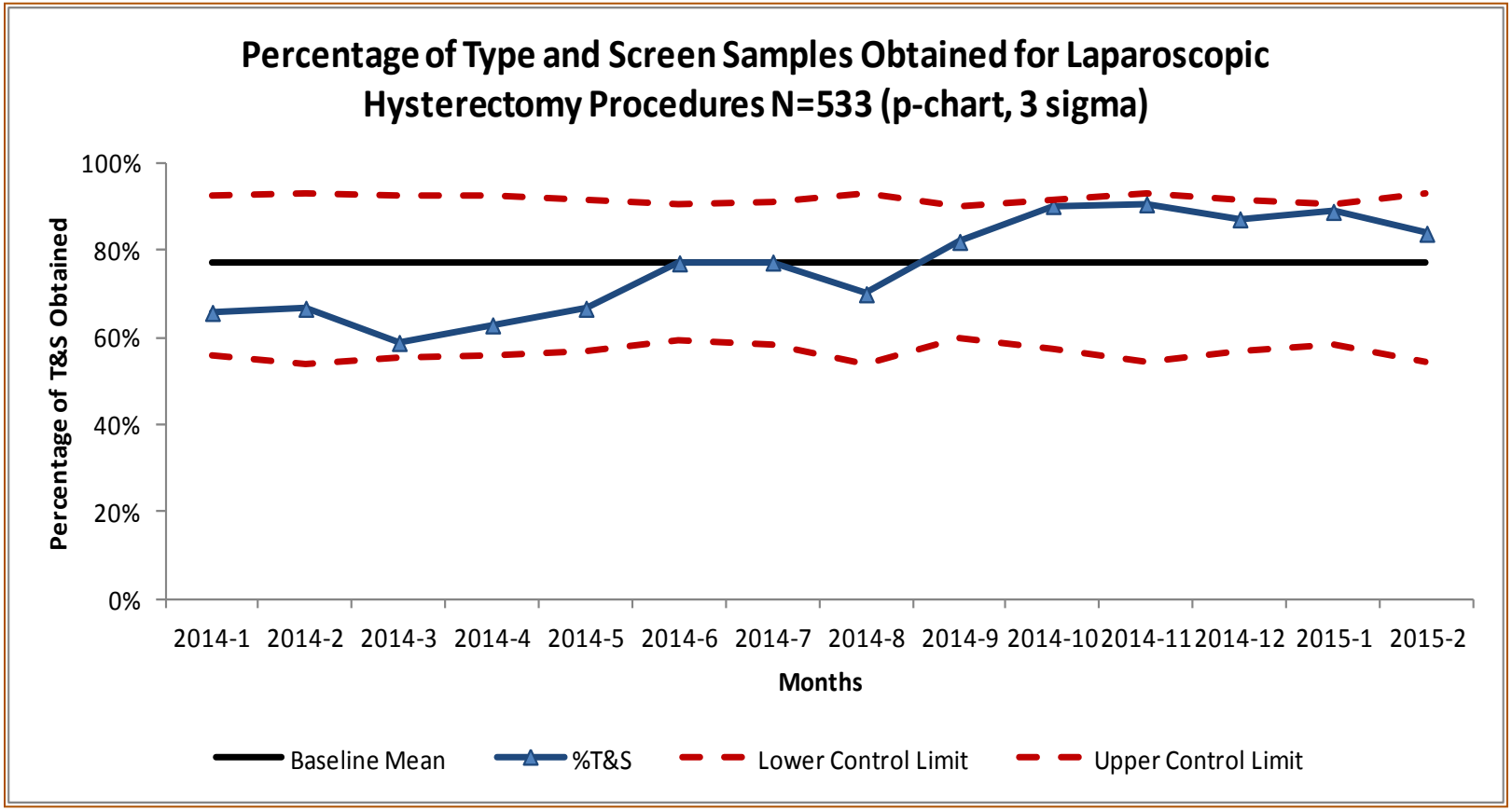


Process Map


In Surgeon's Office
In PATA
Intra-Op
Send To PATA
YES
NO
Phone Screen Evaluation
NEED T&S ?
YES
NO
No blood draw
Draw BBS
Active BBS
T&C
YES
NO
No plans to transfuse in OR
Send to OR
Transfuse?
NO
YES
Blood Check
Transfuse

Baseline Variability

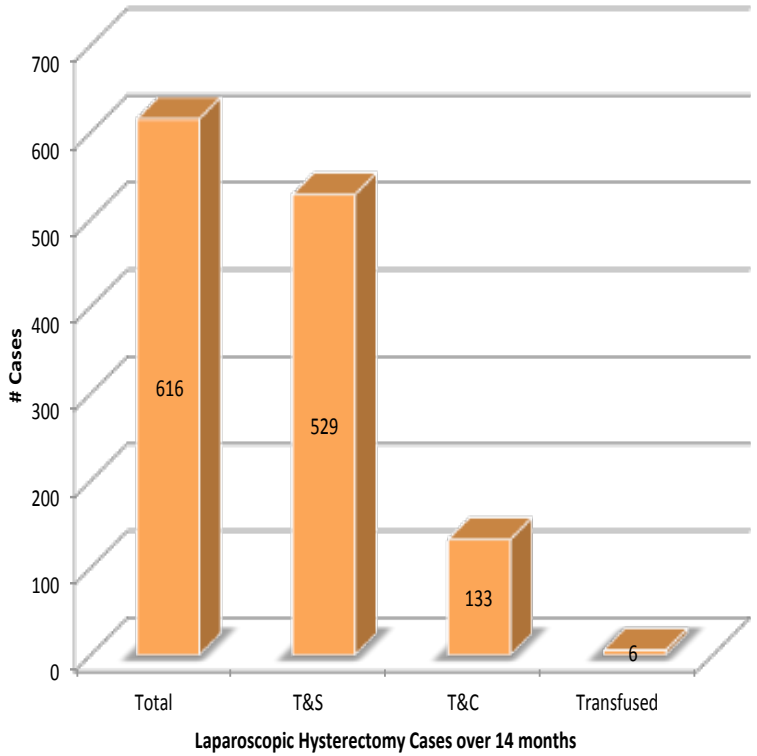
- Lack of guidelines
- Evolution of surgical techniques
  - Laparoscopy
  - Robotic
  - Hemostatic techniques (surgical or agents)
- Over-ordering becomes commonplace

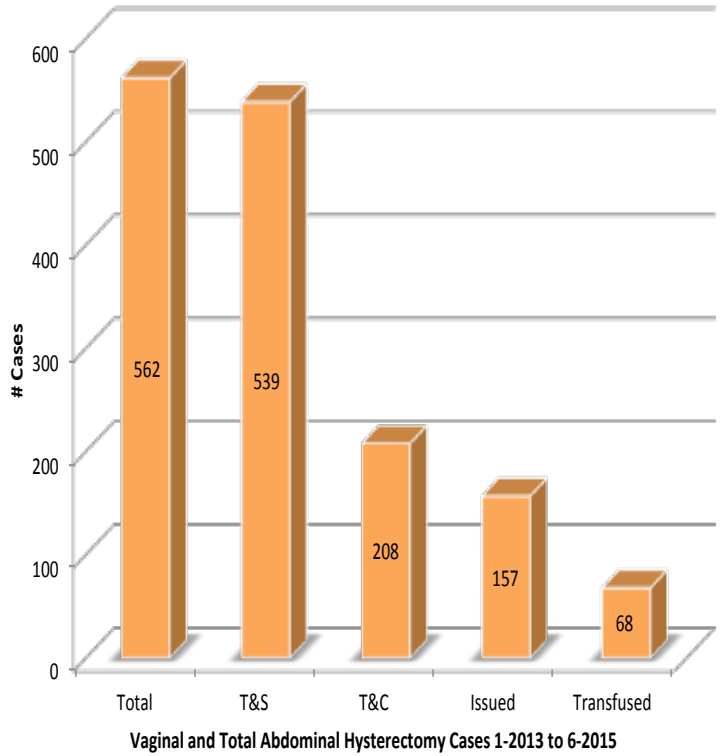


Preliminary data

- Laparoscopic Hysterectomy
- Open Hysterectomy
- Laparoscopic Appendectomy
- Laparoscopic Cholecystectomy
- Hernia Repair
- Cystoscopy
- Liver resection

Data: Hysterectomy Cases

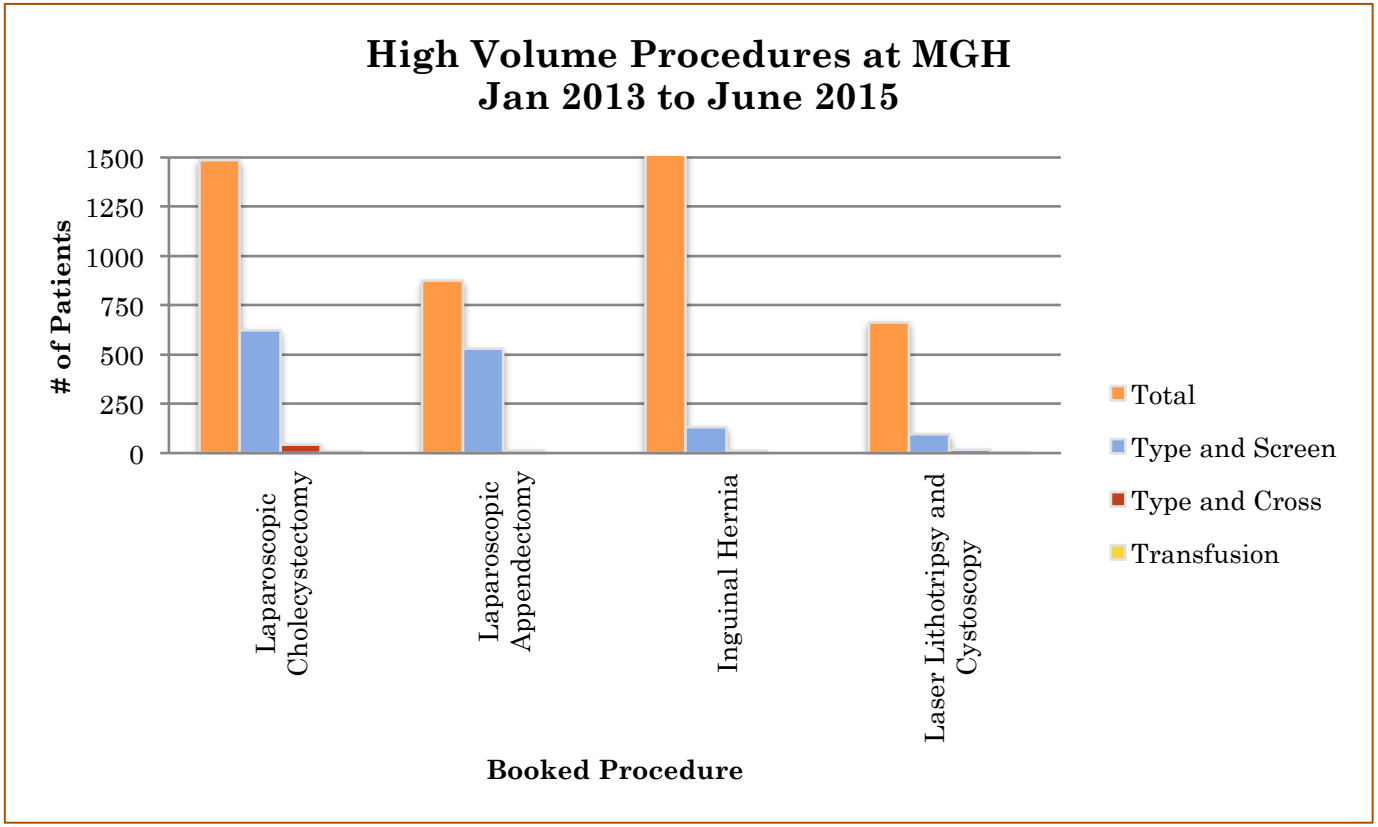




T&S ordered	T&C ordered	Transfused
86%	21%	1%

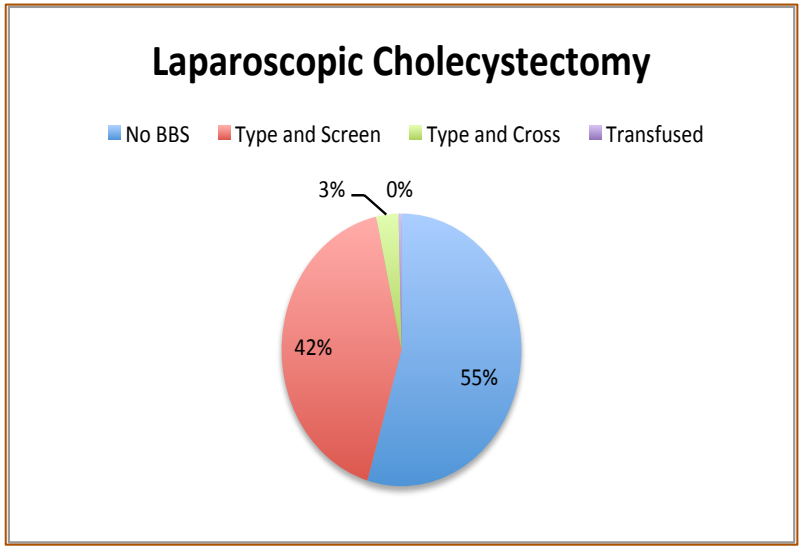
T&S ordered	T&C ordered	Issued	Transfused
96%	37%	28%	12%

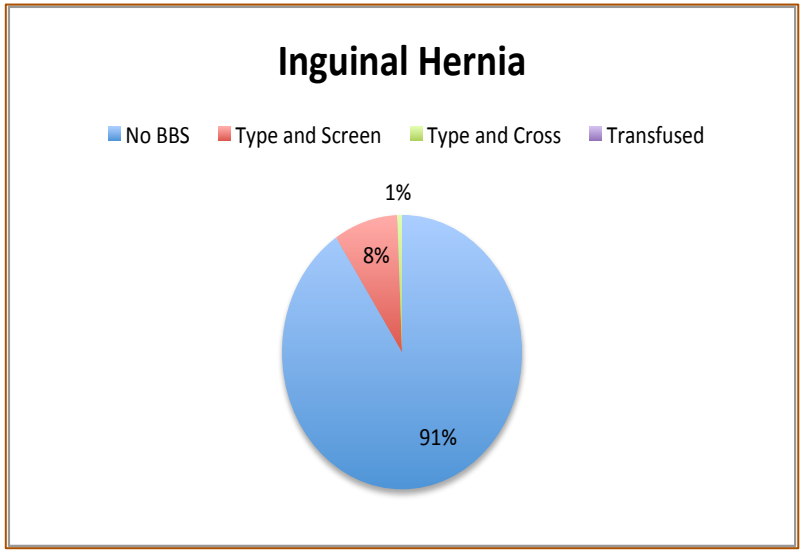
Data: High Volume Procedures

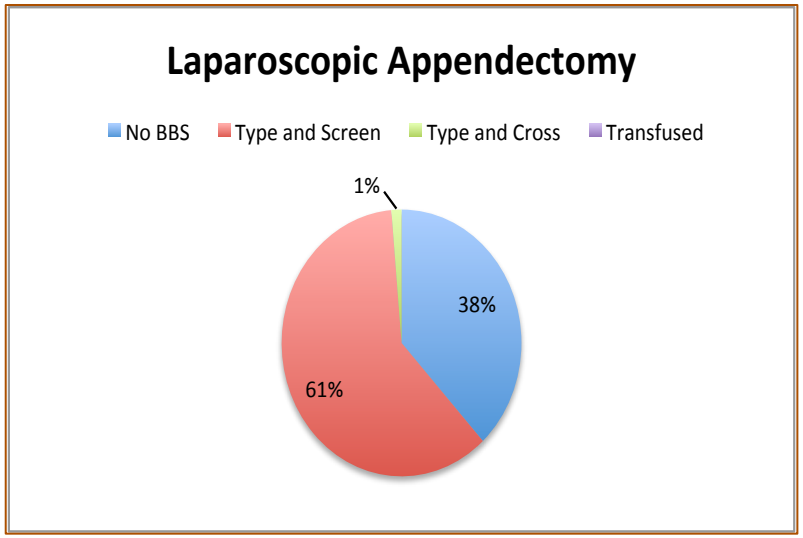


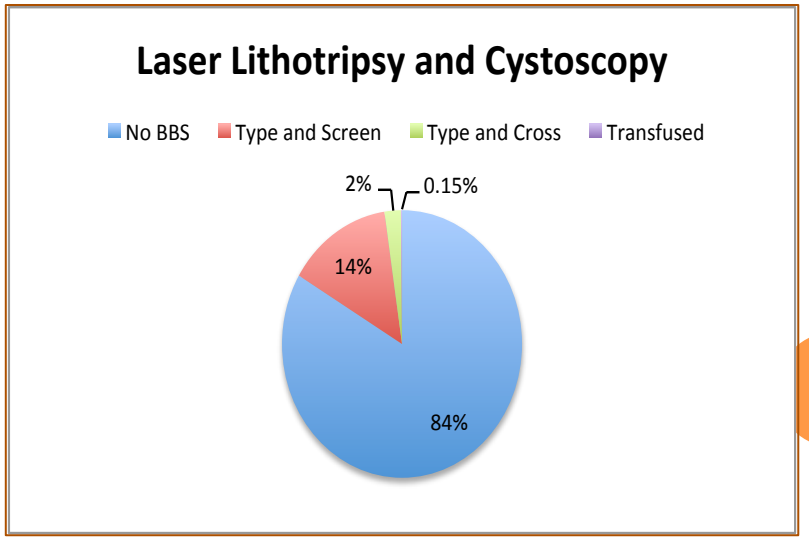
	Laparoscopic Cholecystectomy	Laparoscopic Appendectomy	Inguinal Hernia	Laser Lithotripsy and Cystoscopy
Total	1487	876	1531	665
Type and Screen	625	530	132	94
Type and Cross	45	12	10	15
Transfusion	**6**	**0**	**0**	**1**

Data: High Volume Procedures

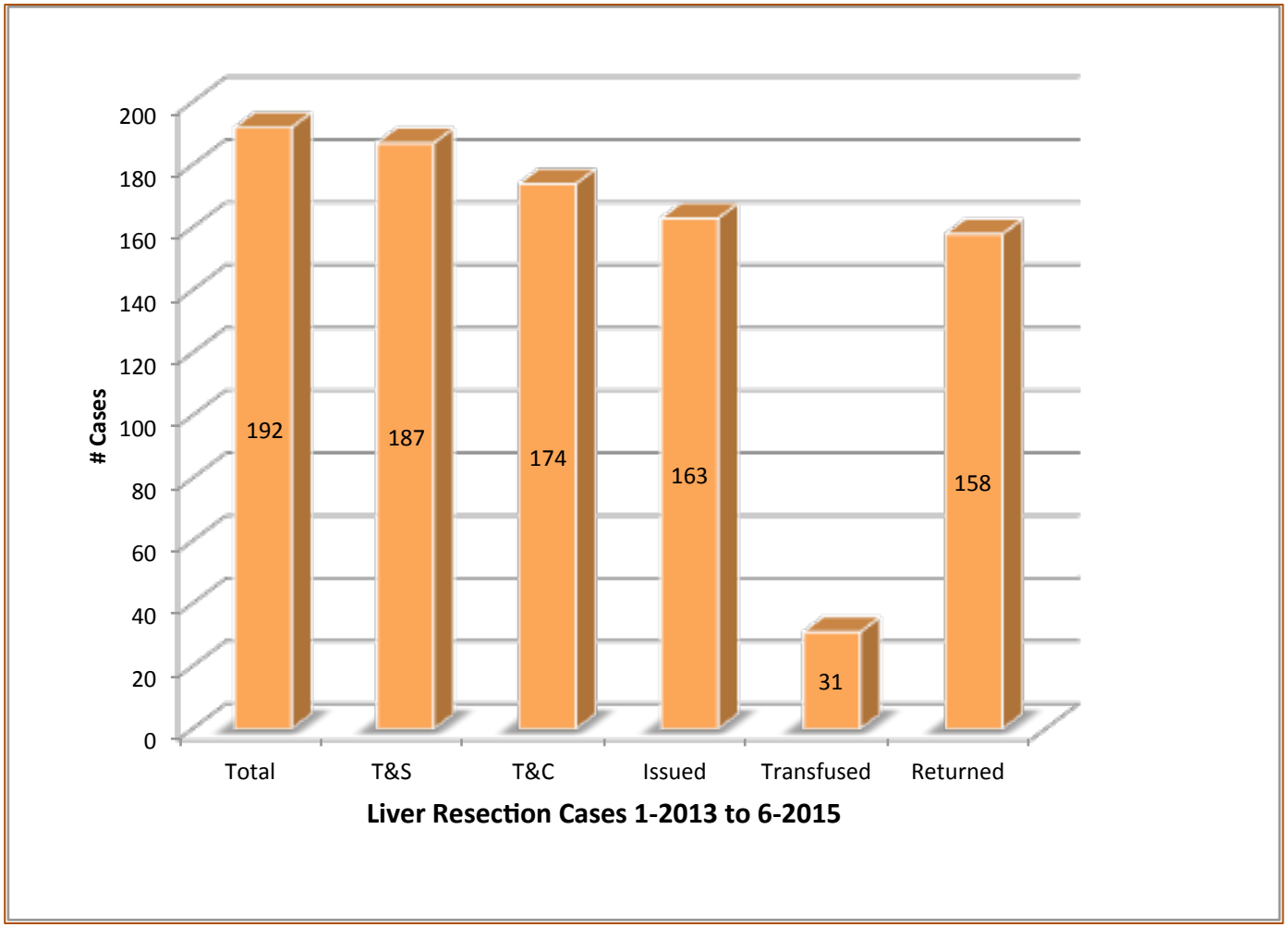








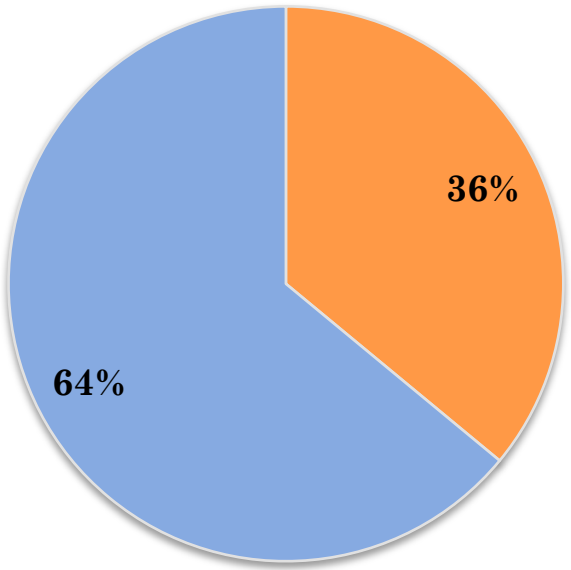
Data: Liver Resection Counts (2013-15)



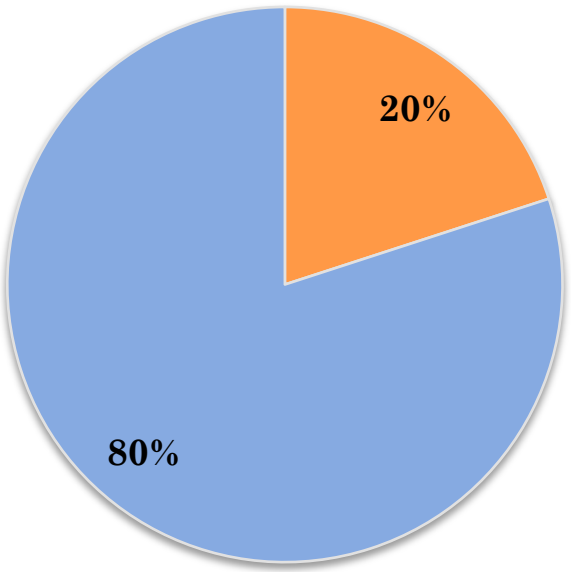
T&S ordered	T&C ordered	Issued	Transfused
97%	91%	84%	16%

RBC USAGE: TRANSFUSED VS. RETURNED

Open Hysterectomy



Liver Resection



Units Transfused

Units Returned

	Units Issued	Units Transfused	Units Returned	Returned
Hyst	457	166	291	64%
Liver	576	112	459	80%

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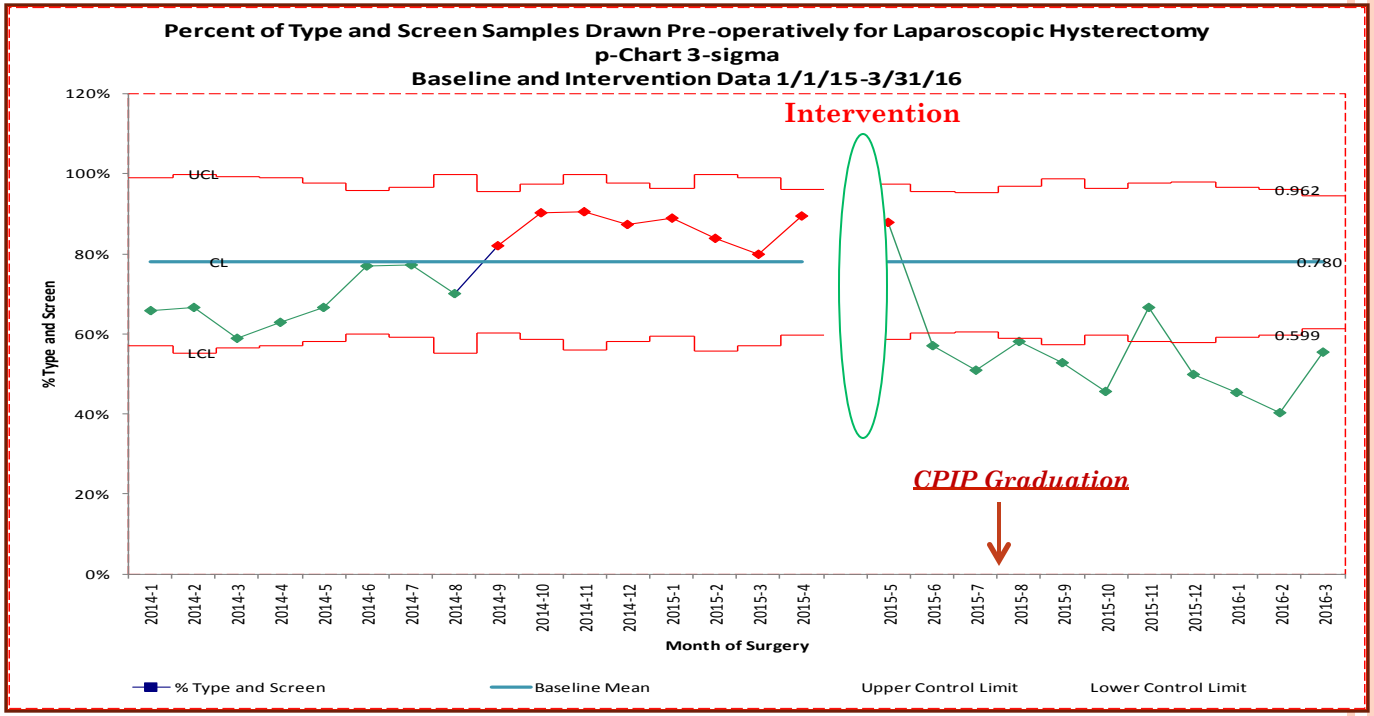
MASSACHUSETTS GENERAL HOSPITAL

Decreasing Variability in Blood Transfusion Preparation for Laparoscopic Hysterectomy Procedures

Results:

- PATA decreased Pre-op orders of T&S
- Anesthesia providers decreased drawing of pre-op T&S
- GYN surgeons agreeable to holding off routine drawing



CONCLUSIONS:

- Routine preoperative type and screen and cross-matching for certain procedures may be a misuse of resources
- Decreasing the routine ordering of T&S through PATA provided minimal change
- Development of this methodology for other procedures is a slow process
- Adoption of a new electronic health record provided an opportunity to implement a preparation for transfusion guideline

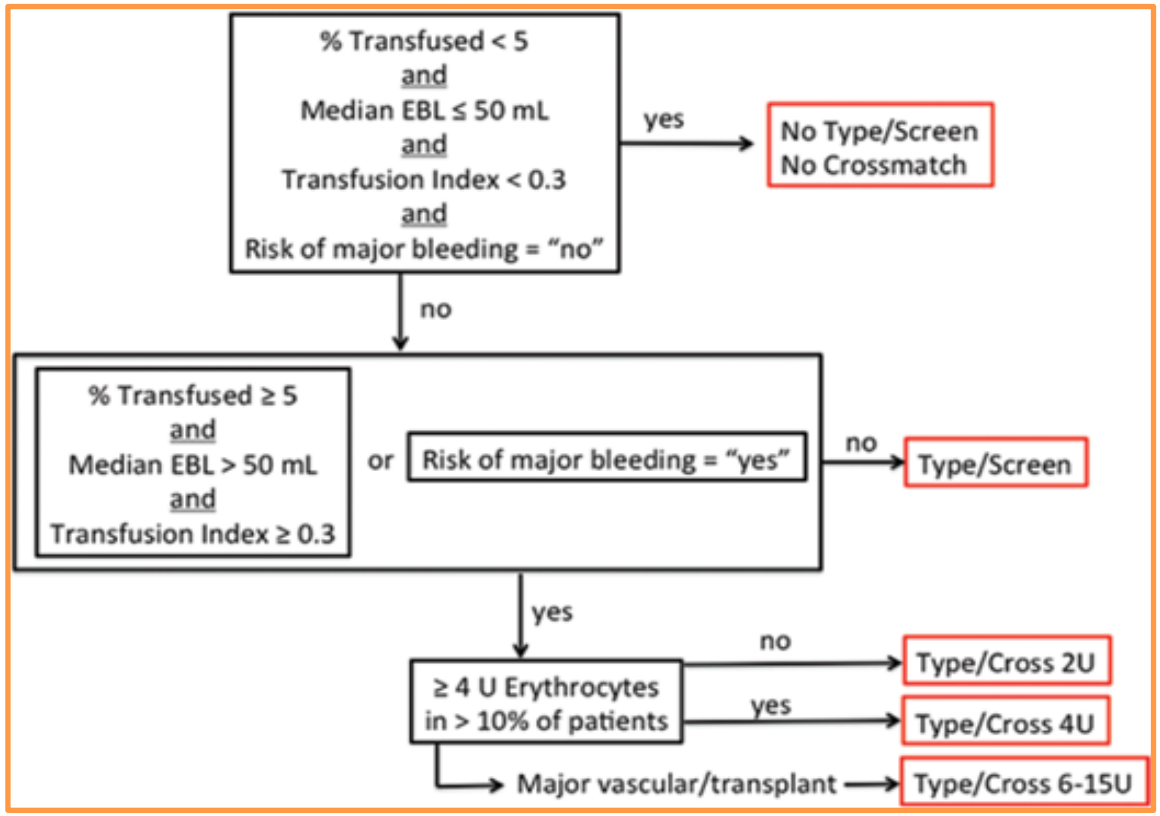
NEXT STEPS:

- Examine transfusion rates for high volume, low risk procedure at MGH
- Teach the use of the SSBOS within EPIC to various work flows: Surgery, Peri-operative nursing, Anesthesia and Blood Bank
- Audit the use of SSBOS for optimization
- Capture data for the development of large-scale transfusion measures
- Explore possibility of an algorithmic approach to determine transfusion risk

Anesthesiology, June, 2013

Optimizing Preoperative Blood Ordering with Data Acquired from an Anesthesia Information Management System

Steven M. Frank, M.D.,* James A. Rothschild, M.D.,† Courtney G. Masear, M.D.,‡
Richard J. Rivers, M.D.,* William T. Merritt, M.D.,* Will J. Savage, M.D.,§ Paul M. Ness, M.D.||



Algorithm to create guidelines- SSBOS

**Hopkins Study*

SURGICAL BLOOD ORDER SCHEDULE

Cardiac Surgery

Case Category	Rec
Heart or lung transplant	T/C 4U
Minimally invasive valve	T/C 4U
Revision sternotomy	T/C 4U
CABG/valve	T/C 4U
Open heart surgery	T/C 4U
Assist device	T/C 4U
Cardiac/major vascular	T/C 4U
Open ventricle	T/C 4U
CABG	T/C 2U
Cardiac wound surgery	T/C 2U
Percutaneous cardiac	T/C 2U
Pericardium	T/C 2U
Lead extraction	T/C 2U
AICD/pacemaker placement	T/S

General Surgery

Case Category	Rec
AP resection	T/C 2U
Intra-abdominal GI	T/C 2U
Whipple or pancreatic	T/C 2U
Liver resection	T/C 2U
Retroperitoneal	T/C 2U
Substernal	T/C 2U
Bone marrow harvest	T/S
Hernia – Ventral/Incisional	T/S
Hernia – Inguinal/Umbilical	No Sample
Appendectomy	No Sample
Abdomen/chest/soft tissue	No Sample
Lap. or open cholecystectomy	No Sample
Thyroid/parathyroid	No Sample
Central venous access	No Sample
Any Breast – except w/flaps	No Sample

Gynecological Surgery

Case Category	Rec
Uterus open	T/C 2U
Open pelvic	T/C 2U
Uterus/ovary	T/S
Total vaginal hysterectomy	T/S
Cystectomy robotic assisted	T/S
Cystoscopy	No Sample
External genitalia	No Sample
GYN cervix	No Sample
Hysteroscopy	No Sample
Superficial wound	No Sample

Neurosurgery

Case Category	Rec
Thoracic/Lumbar/Sacral fusion	T/C 4U
Spine tumor	T/C 2U

Obstetrics

Case Category	Rec
Complex Cesarean (Accreta, Percreta, Previa, etc.)	T/C 4U
Repeat Cesarean	T/C 2U
Routine Primary Cesarean	T/S
Vaginal Delivery	T/S
D&C/D&E/Genetic Termination	T/S
Tubal Ligation	No Sample
Cerclage	No Sample

Orthopedic Surgery

Case Category	Rec
Thoracic/Lumbar/Sacral fusion	T/C 4U
Pelvic orthopedic	T/C 4U
Open hip	T/C 2U
Femur open	T/C 2U
Above/below knee amputation	T/C 2U
Humerus open	T/S
Fasciotomy	T/S
Shoulder Incision & Drainage	T/S
Tibial/fibular	T/S
Total knee replacement	T/S
Shoulder open	T/S
Knee open	T/S
Thigh soft tissue	No Sample
Ortho external fixation	No Sample
Peripheral nerve/tendon	No Sample
Lower extremity I&D	No Sample
Hand orthopedic	No Sample
Upper extremity arthroscopy	No Sample
Upper extremity open	No Sample
Podiatry/Foot	No Sample
Hip closed/percutaneous	No Sample
Lower extremity arthroscopic	No Sample
Shoulder closed	No Sample
Tibial/fibular closed	No Sample

Otolaryngology Surgery

Case Category	Rec
Laryngectomy	T/C 2U
Facial reconstruction	T/C 2U
Cranial surgery	T/C 2U
Radical neck dissection	T/C 2U
Carotid body tumor	T/C 2U
Mandibular surgery	T/S
Neck dissection	T/S
Mastoidectomy	No Sample
Parotidectomy	No Sample
Facial plastic	No Sample
Oral surgery	No Sample
Sinus surgery	No Sample

Thoracic Surgery

Case Category	Rec
Esophageal open	T/C 2U
Sternal procedure	T/C 2U
Chest wall	T/C 2U
Thoracotomy	T/C 2U
Pectus repair	T/C 2U
VATS	T/S
Mediastinoscopy	T/S
EGD/FOB	No Sample
Central venous access	No Sample

Urology

Case Category	Rec
Cystoprostatectomy	T/C 2U
Urology open	T/C 2U
Nephrectomy	T/C 2U
Lap/Robotic kidney/adrenal	T/S
RRP	T/S
Percutaneous nephrolithotomy	T/S
Robotic RRP	No Sample
External genitalia/Penile	No Sample
TURP	No Sample
Cysto/ureter/urethra	No Sample
TURBT	No Sample

Vascular/Transplant Surgery

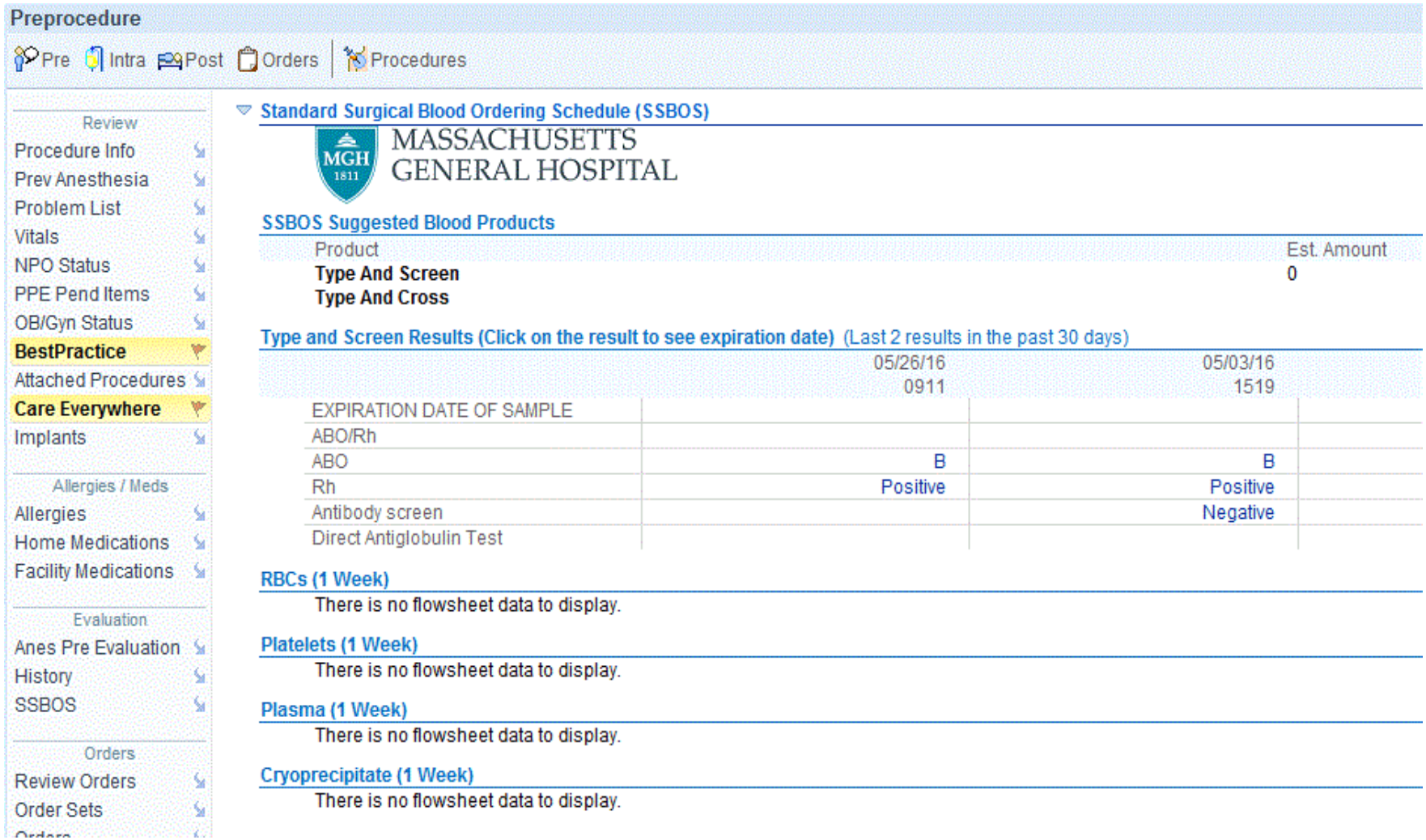
Case Category	Rec
Liver transplant	T/C 15U
Thoracoabdominal aortic	T/C 15U
Major liver resection	T/C 4U
Major vascular	T/C 4U
Exploratory lap. vascular	T/C 4U
Kidney pancreas transplant	T/C 2U
Major endovascular	T/C 2U
Above/below knee amputation	T/C 2U
Nephrectomy/kidney transplant	T/C 2U
Organ procurement	T/C 2U
Peripheral vascular	T/C 2U
Vascular wound I and D	T/C 2U
Carotid vascular	T/S
AV fistula	T/S
Peripheral endovascular	T/S
Angio/Arteriogram	No Sample
Peripheral wound I&D	No Sample
1st rib resection/thoracic outlet	No Sample
Superficial or skin	No Sample
Foot/toe amputation/debride	No Sample
Central venous access	No Sample

First updated blood order schedule in 30 years, and first ever based on actual blood utilization data

Urology

Case Category	Rec
Cystoprostatectomy	T/C 2U
Urology open	T/C 2U
Nephrectomy	T/C 2U
Lap/Robotic kidney/adrenal	T/S
RRP	T/S
Percutaneous nephrolithotomy	T/S
Robotic RRP	No Sample
External genitalia/Penile	No Sample
TURP	No Sample
Cysto/ureter/urethra	No Sample
TURBT	No Sample

EPIC

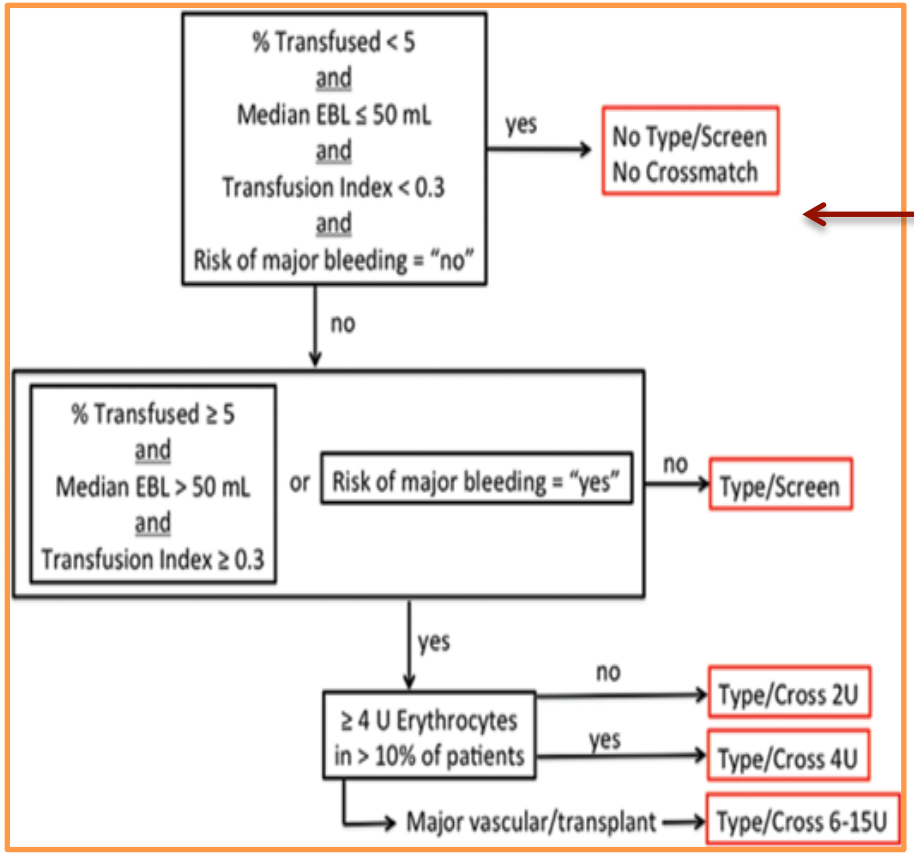

Preprocedure
Pre
Intra
Post
Orders
Procedures
Review
Procedure Info
Prev Anesthesia
Problem List
Vitals
NPO Status
PPE Pend Items
OB/Gyn Status
BestPractice
Attached Procedures
Care Everywhere
Implants
Allergies / Meds
Allergies
Home Medications
Facility Medications
Evaluation
Anes Pre Evaluation
History
SSBOS
Orders
Review Orders
Order Sets
Standard Surgical Blood Ordering Schedule (SSBOS)
MASSACHUSETTS GENERAL HOSPITAL
SSBOS Suggested Blood Products
Product
Est. Amount
Type And Screen
0
Type And Cross
Type and Screen Results (Click on the result to see expiration date) (Last 2 results in the past 30 days)
05/26/16 0911
05/03/16 1519
EXPIRATION DATE OF SAMPLE
ABO/Rh
ABO
B
B
Rh
Positive
Positive
Antibody screen
Negative
Direct Antiglobulin Test
RBCs (1 Week)
There is no flowsheet data to display.
Platelets (1 Week)
There is no flowsheet data to display.
Plasma (1 Week)
There is no flowsheet data to display.
Cryoprecipitate (1 Week)
There is no flowsheet data to display.

Standard Surgical Blood Order Schedule (SSBOS)

- Institute-specific updated schedule done at Johns Hopkins to guide pre-operative blood ordering
- Primary blood ordering categories:
  - "no T/S or T/C"
  - "T/S"
  - "T/C"
- Important caveats:
  - Data from one institution
  - Intra-operative transfusion data included but does not take into account postoperative transfusion

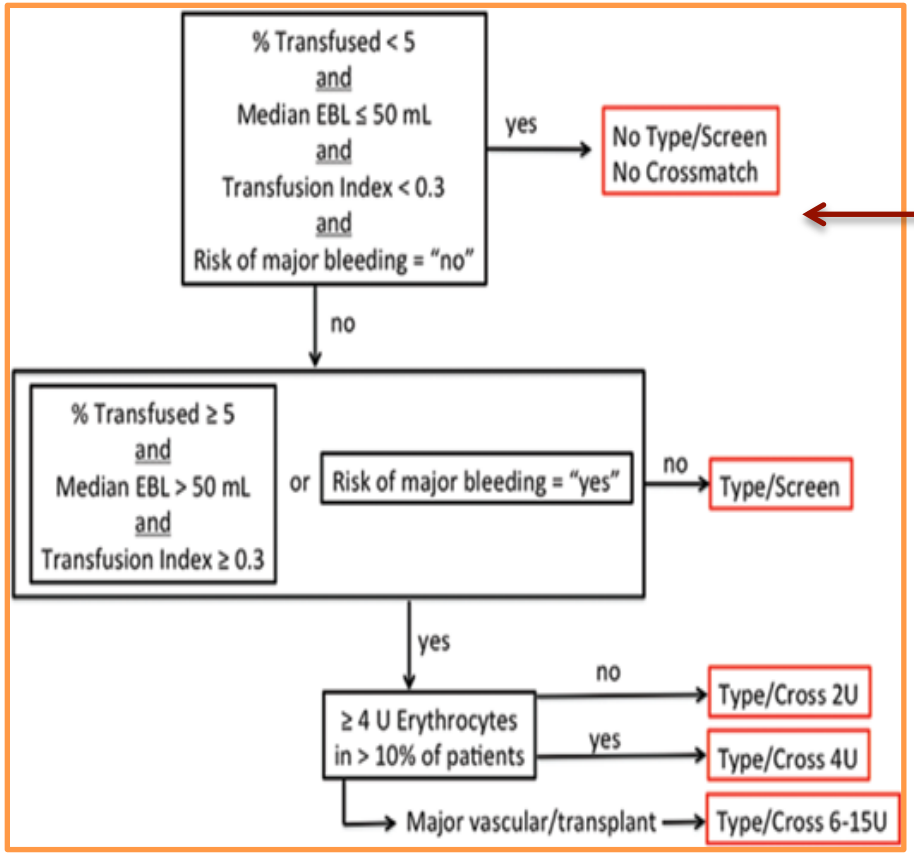
Frank SM, Oleyar MJ, Ness PM, Tobian AAR. Reducing Unnecessary Preoperative Blood Orders and Costs by Implementing an Updated Institution-specific Maximum Surgical Blood Order Schedule and a Remote Electronic Blood Release System. *Anesthesiology*. 2014;121(3):501-509.

The "What if" scenario…



<5% transfused

The "What if" scenario…



<5% transfused

Uncrossmatched blood

CASE *(EMILY NAOUM, MD, RESIDENT CASE CONFERENCE)*

- 20 year old woman presents for an I&D of a LLE wound with vac placement

Case continued

- PMH: pedestrian struck 3 months ago, otherwise healthy
  - Multiple fractures
- PSH: tibia/fibula fracture fixation, skin graft, muscle flap
- Medications: Oxycodone PRN
- NKDA

Case continued

- Physical Exam:
  - Height 5'1" Weight 50 kg
  - Reassuring airway exam
  - Unremarkable CV, respiratory, abdominal, and neurological exam
- Laboratory Studies

	9/7/2016 1545	9/7/2016 1554	
COMPLETE BLOOD COUNT			
WBC		8.03	
RBC		3.31	▼
Hgb		7.9	▼
HCT		26.4	▼
MCV		79.8	▼
MCH		23.9	▼
MCHC		29.9	▼
PLT		467	▲
MPV		9.5	
RDW		16.0	▲

Case continued

- Outside Imaging per Orthopedic Surgery Note:
  - Recent CT scan shows the back of the tibial fracture with large anterior defect; repair and the wound clearly go down into the tibial shaft

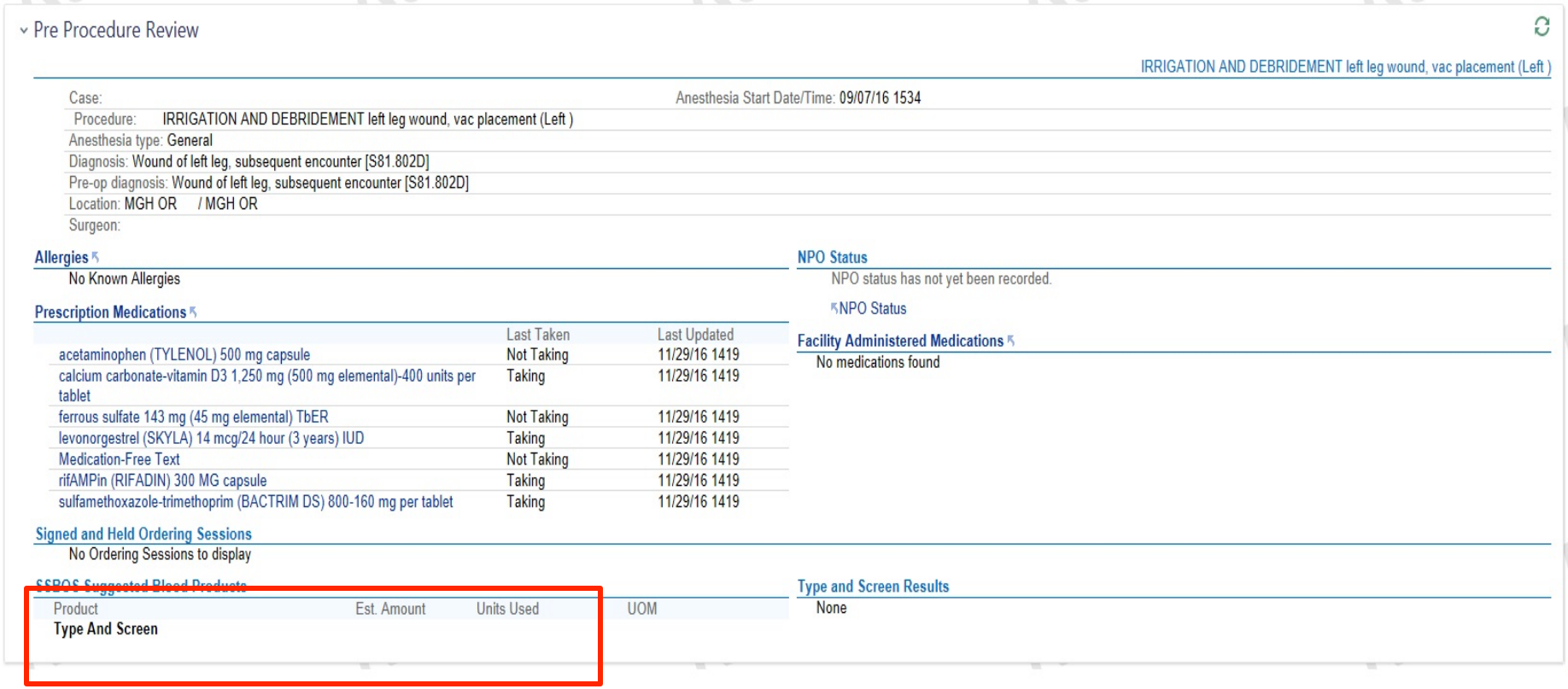
Who should get a Blood Bank Sample?

- Partners Surgical Blood Ordering Schedule

Orthopedic Surgery

Case Catergory	Rec
Thoracic/Lumbar/Sacral fusion	T/C 2U
Pelvic orthopedic	T/C 4U
Open hip (including THR revision)	T/C 2U
Femor open	T/C 2U
Above/Below knee amputation	T/C 2U
Humerus open	T/S
Fasciotomy	T/S
Shoulder Incision & drainage	T/S
Tibial/fibular	T/S
Total hip arthroplasty	T/S
Total Knee replacement	T/S
Shoulder open	T/S
Knee open	T/S
Sports Shoulder	T/S
Thigh soft tissue	No sample
Ortho external fixation	No sample
Peripheral nerve/tendon	No sample
Peripheral vascular	T/S
Vascular wound I and D	T/S
carotid vascular	T/S
AV fistula	T/S
Periopheral endovascular	T/S
Angio/Arteriogram	No Sample
Peripheral wound I&D	No Sample
1st rib resection/thoracic outlet	No Sample
Superficial or skin	No Sample
Foot/toe amputation/debride	No Sample

How might I find recommendations for my patient in the all-knowing Epic?



Pre Procedure Review

IRRIGATION AND DEBRIDEMENT left leg wound, vac placement (Left)

Case:
Anesthesia Start Date/Time: 09/07/16 1534
Procedure: IRRIGATION AND DEBRIDEMENT left leg wound, vac placement (Left)
Anesthesia type: General
Diagnosis: Wound of left leg, subsequent encounter [S81.802D]
Pre-op diagnosis: Wound of left leg, subsequent encounter [S81.802D]
Location: MGH OR / MGH OR
Surgeon:

Allergies
No Known Allergies

NPO Status
NPO status has not yet been recorded.
NPO Status

Prescription Medications

	Last Taken	Last Updated
acetaminophen (TYLENOL) 500 mg capsule	Not Taking	11/29/16 1419
calcium carbonate-vitamin D3 1,250 mg (500 mg elemental)-400 units per tablet	Taking	11/29/16 1419
ferrous sulfate 143 mg (45 mg elemental) TbER	Not Taking	11/29/16 1419
levonorgestrel (SKYLA) 14 mcg/24 hour (3 years) IUD	Taking	11/29/16 1419
Medication-Free Text	Not Taking	11/29/16 1419
rifAMPin (RIFADIN) 300 MG capsule	Taking	11/29/16 1419
sulfamethoxazole-trimethoprim (BACTRIM DS) 800-160 mg per tablet	Taking	11/29/16 1419

Facility Administered Medications
No medications found

Signed and Held Ordering Sessions
No Ordering Sessions to display

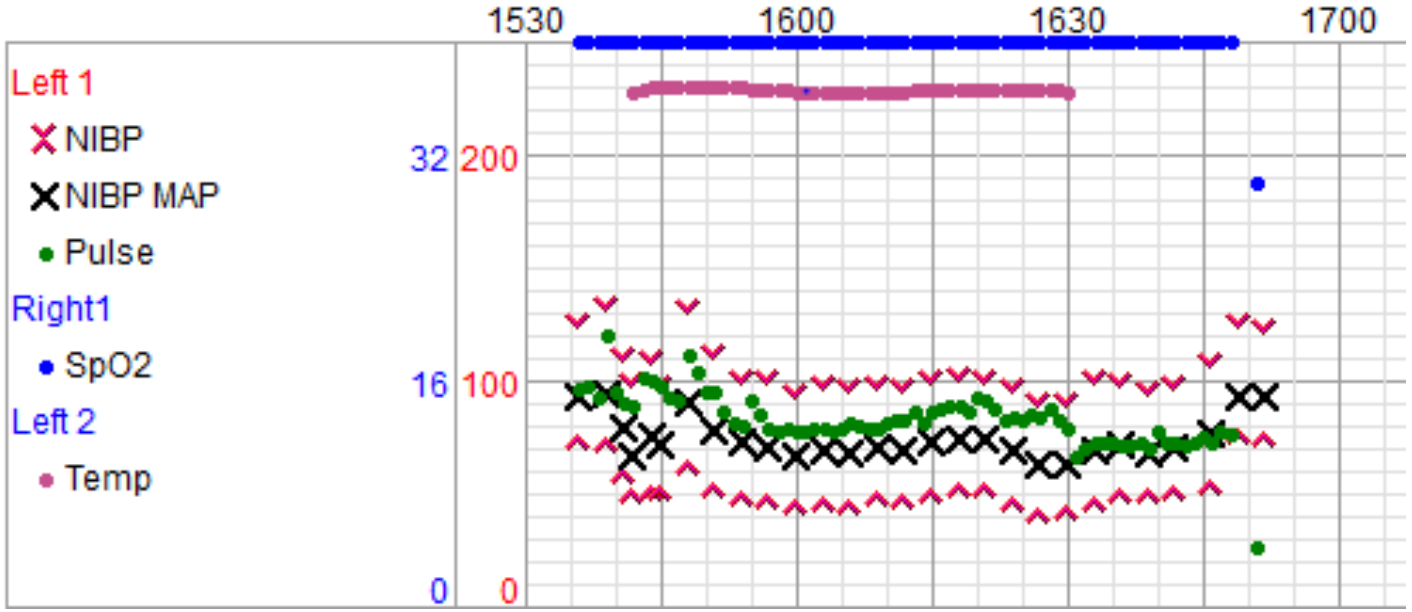
SSBOS Suggested Blood Products

Product	Est. Amount	Units Used	UOM
Type And Screen			

Type and Screen Results
None

Intraoperative Course

- GA, LMA
- EBL 30 mL
- IVF 1000 mL LR



Surgical hand-off to PACU nurse

- I&D of left leg wound
- Placement of wound vac

PACU Course

15 Min:	1630	1645	1700
Vitals			
Temp		36.9 ...	
Temp Source		Temp...	
Heart Rate		105	86
Pulse (SpO2)		103	84
Rhythm		Norm...	
BP (cuff)		127/77	
BP Location		Left ...	
BP Method		Autom...	
Orthostatic Position		Lying...	
Respiratory Rate		18	
MAP (cuff)		95	
Infusions			
Oxygenation			
Pain/Delirium			
Intake			
I.V.		500	
Blood			
Total In		500	
Output			
Blood		30	
Total Out		30	
I/O Net		470	

PACU Course

15 Min:	1630	1645	1700	1715	1730
Vitals					
Temp		36.9 ...			
Temp Source		Temp...			
Heart Rate		105	86	78	93
Pulse (SpO2)		103	84	80	85
Rhythm		Norm...		Norm...	
BP (cuff)		127/77		127/81	72/38
BP Location		Left ...			
BP Method		Autom...			
Orthostatic Position		Lying...			
Respiratory Rate		18		16	
MAP (cuff)		95		99	
Infusions					
Oxygenation					
Pain/Delirium					
Intake					
I.V.		500			
Blood					
Total In		500			
Output					
Blood		30		1400	
Total Out		30		1400	
I/O Net		470		-1400	

PACU Course continued

- IV Access: 20g R AC, 18 g L wrist
- Surgical team notified
- Blood bank notified – sample sent from PACU

	9/7/2016 1743
TESTS	
Expiration Date of...	09/10/2016 11:5...
ABO	A
Rh	Positive
Antibody screen	Negative

	9/7/2016 1745	
COMPLETE BLOOD COUNT		
WBC	13.88	▲
RBC	3.12	▼
Hgb	7.2	▼
HCT	24.6	▼
MCV	78.8	▼
MCH	23.1	▼
MCHC	29.3	▼
PLT	517	▲
MPV	9.2	
RDW	16.1	▲

	9/7/2016 1753	
ROUTINE COAGULATION		
PT	14.6	▲
PT-INR	1.2	▲
PTT	21.5	▼
Fibrinogen		

Return to OR

- EBL 600 mL
- IVF: 2250 mL LR
- 3 units pRBCs ~ 800 mL
- UOP 300 mL

- Surgical Procedure: vac removal, wound exploration, packing with surgicel, ligation of vessels x 3, “diffuse non-surgical bleeding”
- Transferred to ICU intubated and sedated post-operatively

What are the actual risks of giving uncrossmatched blood?

- Risk of having antibody: 2-11%
- Risk of antibody being clinically significant: 0.6 to 6.4%
- Risk of having clinical reaction
  - Delayed hemolytic transfusion reactions: 0.4%
  - Alloimmunization: 1.8 to 8.6%
- When emergency transfusion is needed to a patient who does not have a "current" pre-transfusion type:
  - O negative red cell units if the recipient is a female under the age of 50 years, or a male under the age of 18 years;
  - O positive red cell units for all other patients; and
  - Conversion to the patient's ABO and Rh type and type as soon as that can be determined.

Gehrie, EA., Torney CA. The Influence of Clinical and Biological Factors on Transfusion-Associated Non-ABO Antigen Alloimmunization: Responders, Hyper-Responders, and Non-Responders. *Transfusion Medicine and Hemotherapy* 41.6 (2014): 420–429.

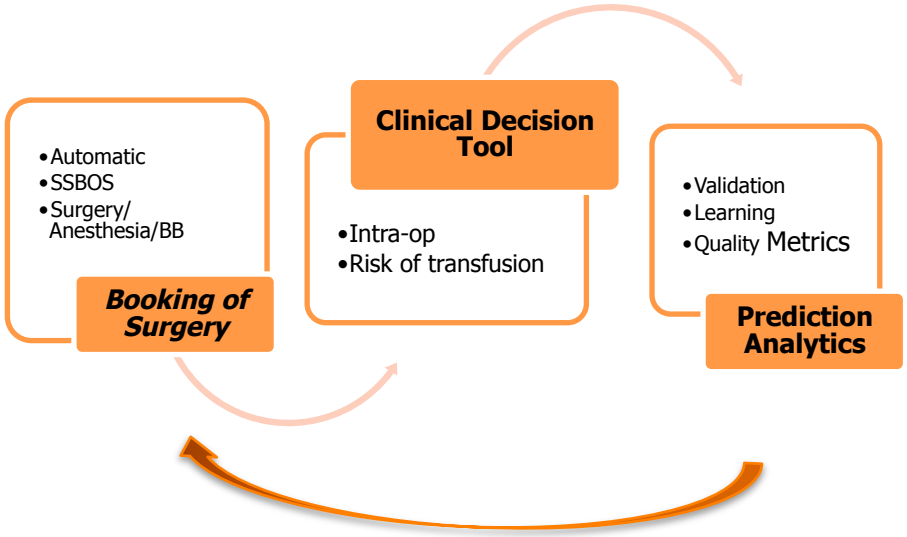
Future Direction

- Balance cost and safety
- Use of data
  - Retrospective
  - Institution-specific
  - Goal-directed
  - Use-specific
- Use of technology

NEXT STEPS:

- Stratify historical transfusion data per procedure
- Identify procedures where T&S in unnecessary
- Gather characteristics from procedures with likelihood of transfusion to identify correlations
- Build transfusion database and model
- *In parallel*, integrate SSBOS into EPIC
- Validate model
- Ensure reporting tools in EPIC captures data

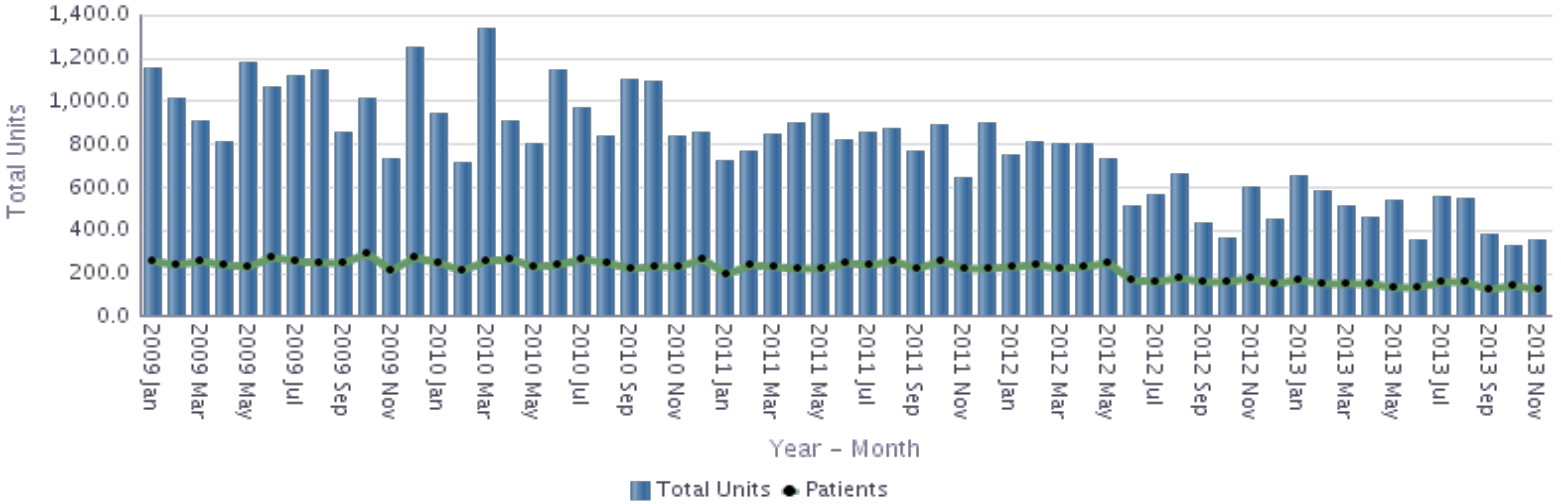
IDEAL PROCESS DESIGN



IMPACT

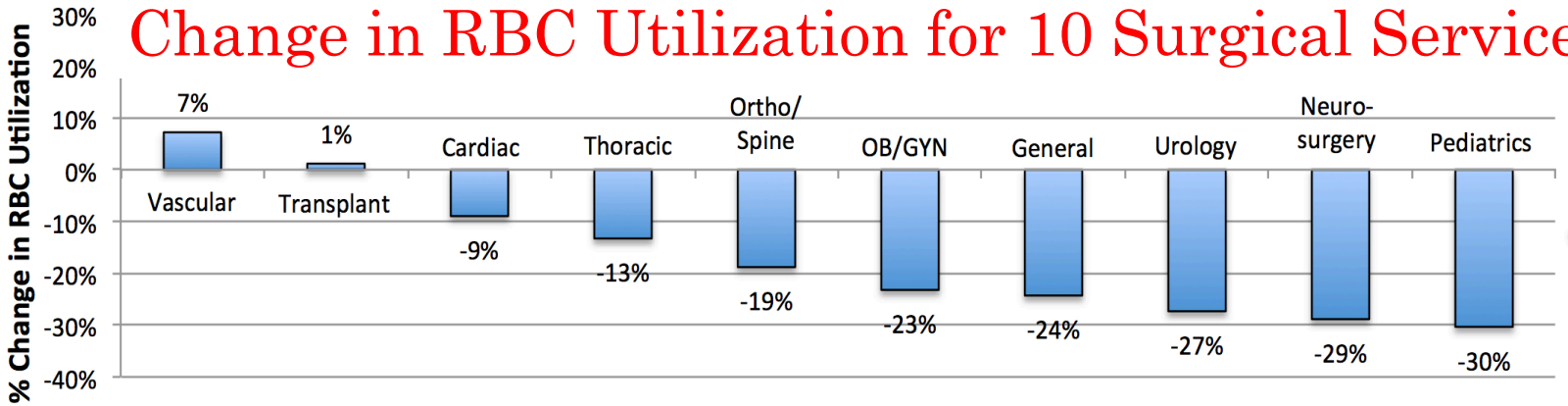
"Efficacy of Education Followed by Computerized Provider Order Entry with Clinician Decision Support to Reduce Red Blood Cell Utilization"

Monthly number of RBC units w/ preceding Hgb > 8



54%

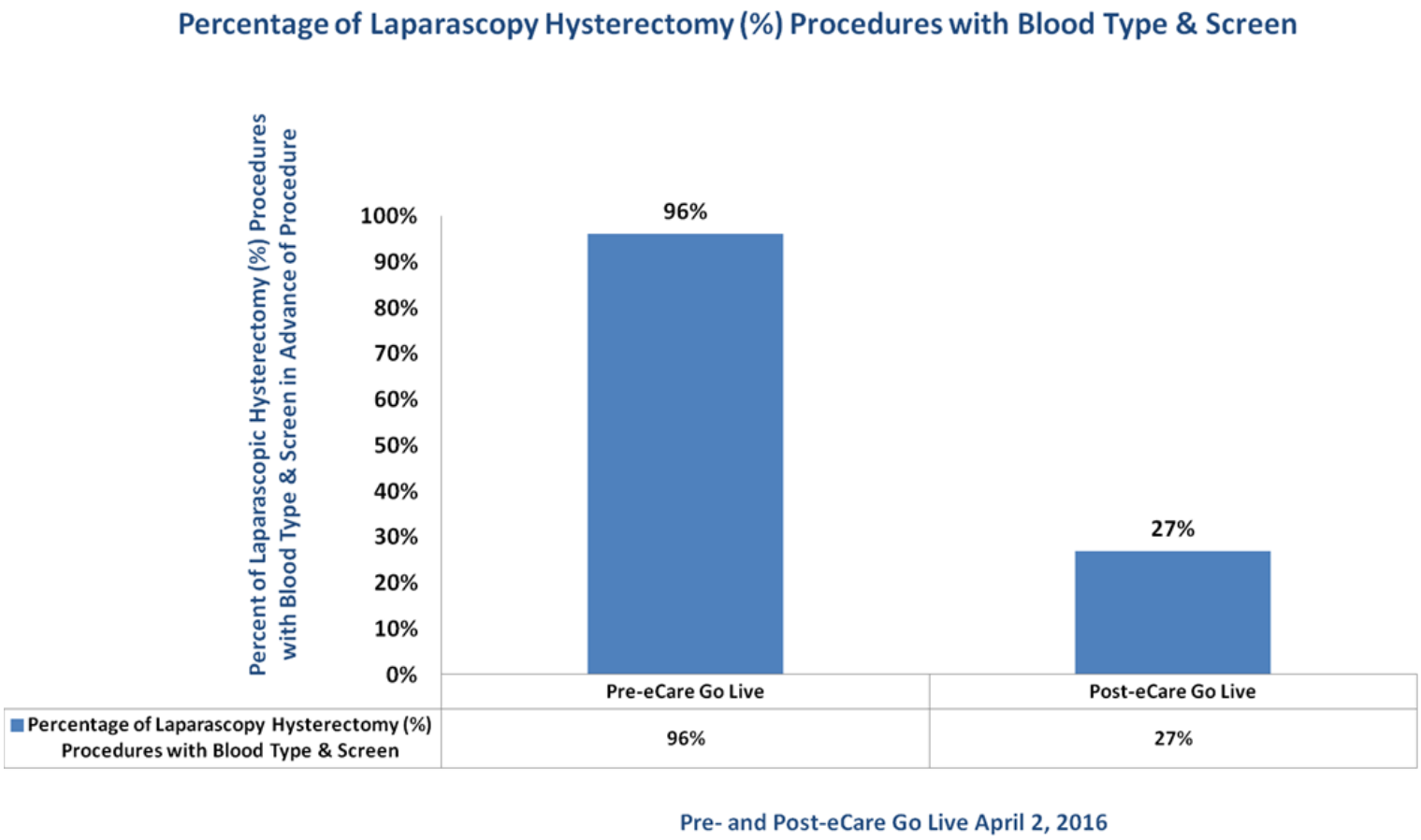
Change in RBC Utilization for 10 Surgical Services



14.3%

Zuckerberg GS, et al. TRANSFUSION, 2015

Post epic implementation



MASSACHUSETTS GENERAL HOSPITAL

IMPACT

PROCESSES AROUND BLOOD PREPARATION

1. Explaining transfusion risk and obtaining informed consent
2. Pre-transfusion examination & clerical routine
3. Phlebotomizing & delivering patient's blood specimen to blood bank & central lab
4. Patient blood testing in central lab & analyzing results - routine & emergency
5. Controlling & storing components in hospital blood bank
6. ABO/Rh-typing new patients
7. ABO/Rh-typing control
8. Antibody screening
9. Cross matching manual distribution of components and controlling delivery received at transfusion site
10. Return deliveries of unused components
11. Cleaning transfusion site & disposing waste
12. Administering and monitoring transfusion

SURGICAL BLOOD ORDER SCHEDULE

Cardiac Surgery

Case Category	Rec
Heart or lung transplant	T/C 4U
Minimally invasive valve	T/C 4U
Revision sternotomy	T/C 4U
CABG/valve	T/C 4U
Open heart surgery	T/C 4U
Assist device	T/C 4U
Cardiac/major vascular	T/C 4U
Open ventricle	T/C 4U
CABG	T/C 2U
Cardiac wound surgery	T/C 2U
Percutaneous cardiac	T/C 2U
Pericardium	T/C 2U
Lead extraction	T/C 2U
AICD/pacemaker placement	T/S

General Surgery

Case Category	Rec
AP resection	T/C 2U
Intra-abdominal GI	T/C 2U
Whipple or pancreatic	T/C 2U
Liver resection	T/C 2U
Retroperitoneal	T/C 2U
Substernal	T/C 2U
Bone marrow harvest	T/S
Hernia – Ventral/Incisional	T/S
Hernia – Inguinal/Umbilical	No Sample
Appendectomy	No Sample
Abdomen/chest/soft tissue	No Sample
Lap. or open cholecystectomy	No Sample
Thyroid/parathyroid	No Sample
Central venous access	No Sample
Any Breast – except w/flaps	No Sample

Gynecological Surgery

Case Category	Rec
Uterus open	T/C 2U
Open pelvic	T/C 2U
Uterus/ovary	T/S
Total vaginal hysterectomy	T/S
Cystectomy robotic assisted	T/S
Cystoscopy	No Sample
External genitalia	No Sample
GYN cervix	No Sample
Hysteroscopy	No Sample
Superficial wound	No Sample

Neurosurgery

Case Category	Rec
Thoracic/Lumbar/Sacral fusion	T/C 4U
Spine tumor	T/C 2U

Obstetrics

Case Category	Rec
Complex Cesarean (Accreta, Percreta, Previa, etc.)	T/C 4U
Repeat Cesarean	T/C 2U
Routine Primary Cesarean	T/S
Vaginal Delivery	T/S
D&C/D&E/Genetic Termination	T/S
Tubal Ligation	No Sample
Cerclage	No Sample

Orthopedic Surgery

Case Category	Rec
Thoracic/Lumbar/Sacral fusion	T/C 4U
Pelvic orthopedic	T/C 4U
Open hip	T/C 2U
Femur open	T/C 2U
Above/below knee amputation	T/C 2U
Humerus open	T/S
Fasciotomy	T/S
Shoulder Incision & Drainage	T/S
Tibial/fibular	T/S
Total knee replacement	T/S
Shoulder open	T/S
Knee open	T/S
Thigh soft tissue	No Sample
Ortho external fixation	No Sample
Peripheral nerve/tendon	No Sample
Lower extremity I&D	No Sample
Hand orthopedic	No Sample
Upper extremity arthroscopy	No Sample
Upper extremity open	No Sample
Podiatry/Foot	No Sample
Hip closed/percutaneous	No Sample
Lower extremity arthroscopic	No Sample
Shoulder closed	No Sample
Tibial/fibular closed	No Sample

Otolaryngology Surgery

Case Category	Rec
Laryngectomy	T/C 2U
Facial reconstruction	T/C 2U
Cranial surgery	T/C 2U
Radical neck dissection	T/C 2U
Carotid body tumor	T/C 2U
Mandibular surgery	T/S
Neck dissection	T/S
Mastoidectomy	No Sample
Parotidectomy	No Sample
Facial plastic	No Sample
Oral surgery	No Sample
Sinus surgery	No Sample

Thoracic Surgery

Case Category	Rec
Esophageal open	T/C 2U
Sternal procedure	T/C 2U
Chest wall	T/C 2U
Thoracotomy	T/C 2U
Pectus repair	T/C 2U
VATS	T/S
Mediastinoscopy	T/S
EGD/FOB	No Sample
Central venous access	No Sample

Urology

Case Category	Rec
Cystoprostatectomy	T/C 2U
Urology open	T/C 2U
Nephrectomy	T/C 2U
Lap/Robotic kidney/adrenal	T/S
RRP	T/S
Percutaneous nephrolithotomy	T/S
Robotic RRP	No Sample
External genitalia/Penile	No Sample
TURP	No Sample
Cysto/ureter/urethra	No Sample
TURBT	No Sample

Vascular/Transplant Surgery

Case Category	Rec
Liver transplant	T/C 15U
Thoracoabdominal aortic	T/C 15U
Major liver resection	T/C 4U
Major vascular	T/C 4U
Exploratory lap. vascular	T/C 4U
Kidney pancreas transplant	T/C 2U
Major endovascular	T/C 2U
Above/below knee amputation	T/C 2U
Nephrectomy/kidney transplant	T/C 2U
Organ procurement	T/C 2U
Peripheral vascular	T/C 2U
Vascular wound I and D	T/C 2U
Carotid vascular	T/S
AV fistula	T/S
Peripheral endovascular	T/S
Angio/Arteriogram	No Sample
Peripheral wound I&D	No Sample
1st rib resection/thoracic outlet	No Sample
Superficial or skin	No Sample
Foot/toe amputation/debride	No Sample
Central venous access	No Sample

Potential savings
$211,448 / year

Impact

Approximate Costs of T&S

MGH	Partners-NSH	*JSLS (2010)*
22.10	16.04	30.00
❖Does not include Instrumentation		❖Maimonides Hospital

$9,921.79 **Lap Hyst Procedures**
$13,812.50 **Lap Cholecystectomies**
$55,000 (JSLS)- Hernias/Appendectomies/Cholecystectomies

Ghirardo SF, Mohan I, Gomensoro A, Chorost MI. Routine Preoperative Typing and Screening: A Safeguard or a Misuse of Resources. *JSLS*. 2010;14:395-398.

World J Surg (2016) 40:1295–1298
DOI 10.1007/s00268-016-3463-8

World Journal of Surgery

ORIGINAL SCIENTIFIC REPORT

Are Routine Blood Group and Save Samples Needed for Laparoscopic Day Case Surgery?

Peter M. Thomson[1] · Jack Ross[1] · Samrat Mukherjee[1] · Borzoueh Mohammadi[1]

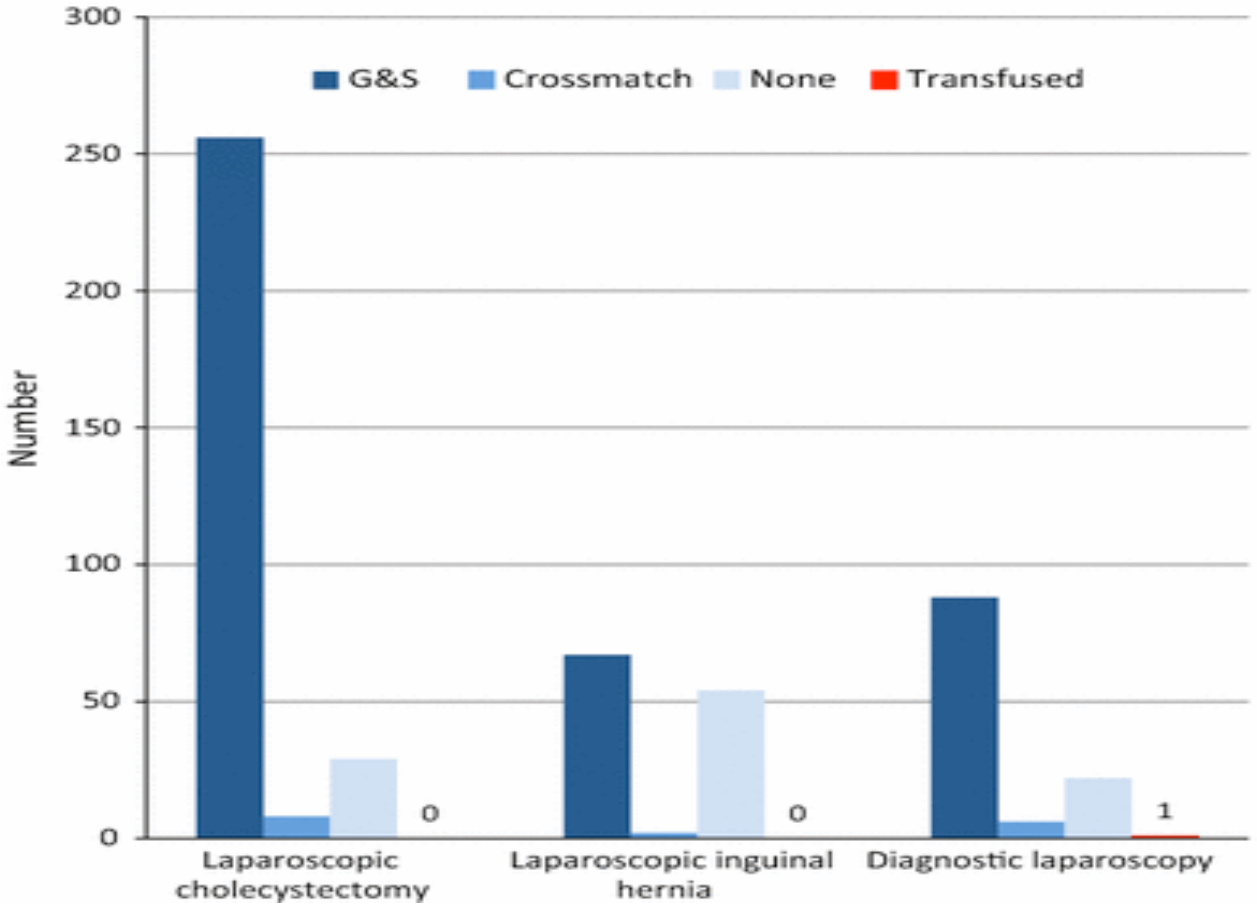


Fig. 1: Pre-operative G&S and peri-operative transfusion status

During the study period, 293 patients underwent laparoscopic cholecystectomy, 123 laparoscopic inguinal hernia repair and 116 diagnostic laparoscopy (excluding gynaecological laparoscopy)

Impact

Patient Safety

- Misdirection of blood bank resources
- ⬇Unnecessary transfusion
- JCAHO

Efficiency

- Improved efficiency- OR, Blood Bank
- Standardization of the process
- National standards

Cost

- Blood is not reimbursed well due to DRGs
- Decreased hospital costs

Shander, A., Hofmann, A., Ozawa, S., & Javidroozi, M. (2008). The True Cost of Red Blood Cell Transfusion in Surgical Patients. Blood, 112(11), 3045. Accessed November 15, 2016. Retrieved from http://www.bloodjournal.org/content/112/11/3045.

Based on these data, the total cost of RBC transfusion per patient transfused in the surgical setting of this hospital was ***US$ 3433***. The total cost of a unit of RBC was ***US$ 1,158*** (2007 value), of which, indirect overhead, total transfusion process cost, weighted average acquisition cost and direct overhead cost per unit accounted for 40.6%, 34.0%, 21.5% and 3.9%, respectively.

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April 2010 of *Transfusion* study findings confirm that annual expenditures on blood and transfusion-related activities for surgical patients are significant resource drains—costing between ***$1.6 to $6.0 million per hospital*** surveyed.
~~~~~

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- **Emily Naoum, MD**

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