The Michigan Trauma Quality Improvement Program

Ypsilanti, MI
October 15, 2013

Wi-Fi
Username: golf
Password: conference

Agenda

- Bryan Cotton
  - Evolution of TQIP Best Practices for Massive Transfusion
- Massive Transfusion QI Projects
  - Bronson
  - Spectrum
- Discussion
  - Cotton, Blostein, Iskander
  - Audience

Agenda

- Analytics Web-Site
- Lunch
- Emergent GS Cholecystectomy Data
- MTQIP Data
- Future Directions
  - Registry (Validation, Data Transfer, Data Elements)
  - Data Collection (Short/Long)
  - Process Measures

Agenda

- Administrative Updates (Mark)
  - New Data Elements
  - BCBS CQI Scoring
- Administrative Updates (Judy)
  - TQIP Meeting
  - Site Visits
  - Resource Benchmarking
  - Individual PI Projects

Information: MTQIP

- New Centers
  - Henry Ford Macomb Hosptial
    - Peter Lopez TMD
    - Chris McEachin TPM, Michelle Jaskot Registrar
  - St. Joseph Mercy Oakland
    - Alicia Kieninger TMD
    - Carol Spinweber TPM, Rebecca Peterson Registrar
  - MacLaren Lapeer Regional Medical Center
    - Ruben Toribio TMD
    - Pamela Wills-Mertz TPM, Erin Veit Registrar

Information: ACS-TQIP

- Benchmark Reports
  - October 2013
- ACS-TQIP Meeting
  - Phoenix AR, November 17-19, 2013
- Data
  - Quarterly data transfers
  - Process measures
  - Select “TQIP Quarterly”
  - Check submission frequency reports

Unblinded Results at MTQIP Meetings

1. Would you be willing to sign a confidentiality agreement at each MTQIP meeting that states you agree to protect the confidentiality of all information discussed at MTQIP.

92% Yes (23/25)

Unblinded Results at MTQIP Meetings

2. Do you think that MTQIP meeting discussions would be more informative if the identification of hospitals results where known, so there could be direct dialogue with those centers and sharing of best practices?

64% Yes (16/25)

Unblinded Results at MTQIP Meetings

3. Are you open to the sharing of identified hospital results if restricted to discussing (process measures) only?

80% Yes (20/25)

Unblinded Results at MTQIP Meetings

4. Are you open to the sharing of identified hospital results even when discussing (outcome measures, such as complications and mortality)?

80% Yes (20/25)

Michigan Society of Thoracic and Cardiovascular Surgeons Quality Collaborative

Confidentiality Agreement

This document is intended to validate the confidentiality of information discussed at Michigan Society of Thoracic and Cardiovascular Surgeons Quality Collaborative meetings under the guidelines set forth by the Michigan Society of Thoracic & Cardiovascular Surgeons.

The purpose of the MSTCVS Quality Collaborative is to i rall quality of care for cardiac surgery patients in the state. R gs will occur and will involve the review of site l STS cardiac surgery data, the identifi ons related to improving

Everyone Signs Confidentiality Agreement at every meeting.

The follow ged and confidential information and should be d nes of the MSTCVS Quality Collaborative meetings.

- Any and all patient information.
- Any and all patient identifiers which are considered privileged and protected health information as defined by current HIPPA laws.
- Any specific Michigan STS site cardiac surgery case information.
- Any information discussed regarding a specific Michigan STS site outcome.
- Any reference to a specific Michigan STS site result or analysis.
- All cardiac surgery data presented including but not limited to Composite Metrics.

By signing this document, I agree to protect the confidentiality of all information discussed at this meeting and take steps to safeguard against any disclosure of privileged information that may have been discussed. I understand that any violation of confidentiality may result in my personal removal from participation in the project as well as the removal of the hospital site I represent.

Meeting Participant Signature: _____ Date: _____

Confidentiality Agreement

- Everyone signs a confidentially agreement for entry to the meeting
- Every meeting
- No photos
- Reports distributed at the end of the meeting

Confidentiality Agreement

The following examples are to be considered privileged and confidential information and should be discussed only within the confines of the MTQIP Quality Collaborative meetings.

- Any and all patient information.
- Any and all patient identifiers which are considered privileged and protected health information as defined by current HIPPA laws.
- Any specific Michigan trauma case information.
- Any information discussed regarding a specific MTQIP site outcome.
- Any reference to a specific MTQIP site result or analysis.
- All trauma data presented including but not limited to Composite Metrics.

Confidentiality Agreement

By signing this document, I agree to protect the confidentiality of all information discussed at this meeting and take steps to safeguard against any disclosure of privileged information that may have been discussed. I understand that any violation of confidentiality may result in my personal removal from participation in the project as well as the removal of the hospital site I represent.

Evolution of TQIP Best Practices for Massive Transfusion

Bryan Cotton, MD

The evolution of TQIP Best Practices for Massive Transfusion

Bryan A Cotton, MD, MPH
Associate Professor of Surgery
Department of Surgery and
The Center for Translational Injury Research
University of Texas Health Science Center
Houston, Texas

Background

- Hemorrhage: most common cause of death within the first hour of arrival.
- >80% of deaths in the OR and nearly 50% of deaths in 1st 24 hours due to hemorrhage.
- While only 3% of civilian traumas will receive a massive transfusion (MT), these patients consume 70% of all trauma blood transfused.

Kauvar DS et al, J Trauma 2006
Sauaia A et al, J Trauma 1995
Como JJ et al, Transfusion 2004

Background

- MT scenarios are unplanned, require processing/delivery of large amounts of products rapidly in a sustained fashion .
- Significant pre-planning and coordination between blood bank, ER, OR and Trauma.
- TQIP set out to identify necessary parts and processes of an MTP and address key issues involved in their development.

Cotton BA et al, J Trauma 2008
O'Keeffee T et al, J Trauma 2008

Why develop a MTP?

- Protocolization of the process is associated with decreased mortality, reduction in overall transfusions and less MOF/ARDS.

- MTP are associated with reduced times to first products available and decrease in blood product wastage.

- These findings are independent of the ratio fo plasma: RBC chosen.

Cotton BA et al, J Trauma 2009
Riskin DJ et al, JACS 2009
Gunter O et al, J Trauma 2009

Damage Control Hematology: The Impact of a Trauma Exsanguination Protocol on Survival and Blood Product Utilization

Bryan A. Cotton, MD, Oliver L. Gunter, MD, James Isbell, MD, Brigham K. Au, BS, Amy M. Robertson, MD, John A. Morris, Jr., MD, Paul St. Jacques, MD, and Pampee P. Young, MD, PhD

Background: The importance of early and aggressive management of trauma-related coagulopathy remains poorly understood. We hypothesized that a trauma exsanguination protocol (TEP) that systematically provides specified numbers and types of blood components immediately upon initiation of resuscitation would improve survival and reduce overall blood product consumption among the most severely injured patients.

Methods: We recently implemented a TEP, which involves the immediate and continued release of blood products from the blood bank in a predefined ratio of 10 units of packed red blood cells (PRBC) to 4 units of fresh frozen plasma to 2 units of platelets. All TEP activations from February 1, 2006 to July 31, 2007 were retrospectively evaluated. A comparison cohort (pre-TEP) was selected from all trauma admissions between August 1, 2004 and January 31, 2006 that (1) underwent immediate surgery by the trauma team and (2) received greater than 10 units of PRBC in the first 24 hours. Multivariable analysis was performed to compare mortality and overall blood product consumption between the two groups.

Results: Two hundred eleven patients met inclusion criteria (117 pre-TEP, 94 TEP). Age, sex, and Injury Severity Score were similar between the groups, whereas physiologic severity (by weighted Revised Trauma Score) and predicted survival (by trauma-related Injury Severity Score, TRISS) were worse in the TEP group (p values of 0.037 and 0.028, respectively). After controlling for age, sex, mechanism of injury, TRISS and 24-hour blood product usage, there was a 74% reduction in the odds of mortality among patients in the TEP group ($p = 0.001$). Overall blood product consumption adjusted for age, sex, mechanism of injury, and TRISS was also significantly reduced in the TEP group ($p = 0.015$).

Conclusions: We have demonstrated that an exsanguination protocol, delivered in an aggressive and predefined manner, significantly reduces the odds of mortality as well as overall blood product consumption.

Key Words: Hemorrhage, Exsanguination, Trauma, Massive transfusion.

J Trauma. 2008;64:1177–1183.

Table 2 Univariate Analyses of Primary and Secondary Outcome Measures

Variable	Pre-TEP (n = 117)	TEP (n = 94)	*p*
30-d mortality (%)	65.8	51.1	0.030*
24-h blood product use (units)	39 ± 28	31.8 ± 19	0.017*
24-h RBC use (units)	19.8 ± 12.8	18.8 ± 11.2	0.695
24-h FFP use (units)	12.4 ± 12.5	9.9 ± 7	0.595
24-h PLT use (units)	6.8 ± 7.2	3.1 ± 3.7	<0.001*
Intraoperative RBC use (units)	11.1 ± 8.5	16 ± 11.4	0.001*
Intraoperative FFP use (units)	4.3 ± 4	8.2 ± 6.8	<0.001*
Intraoperative PLT use (units)	1.1 ± 2.6	2.2 ± 2.3	<0.001*
Intraoperative crystalloid (L)	6.7 ± 4.2	4.9 ± 3.0	0.002*
Unexpected survivors (%)	5.1	22.3	<0.001*
Unexpected deaths (%)	22.2	8.5	0.007*

A Massive Transfusion Protocol to Decrease Blood Component Use and Costs

Terence O'Keeffe, MB, ChB, MSPH; Majed Refaai, MD; Kathryn Tchorz, MD; John E. Forestner, MD; Ravi Sarode, MD

Hypothesis: A massive transfusion protocol (MTP) decreases the use of blood components, as well as turnaround times, costs, and mortality.

Design: Retrospective before-and-after cohort study.

Setting: Academic level I urban trauma center.

Patients and Methods: Blood component use was compared in 132 patients during a 2-year period following the implementation of an MTP; 46 patients who were treated the previous year served as historical control subjects.

Intervention: Introduction of an MTP that included recombinant factor VIIa for patients with exsanguinating hemorrhage.

Main Outcome Measures: The amount of each blood component transfused, turnaround times, blood bank and hospital charges, and mortality rates.

Results: After introduction of the MTP, there was a significant decrease in packed red blood cells, plasma, and platelet use. The turnaround time for the first shipment was less than 10 minutes, and the time between the first and second shipments was reduced from 42 to 18 minutes, compared with historical controls. The decreased use of blood products represented a savings of $2270 per patient or an annual savings of $200 000, despite increased costs for recombinant factor VIIa. There was no difference in mortality in either group; it remained around 50%. Thromboembolic complications did not increase, despite a significant increase in the use of recombinant factor VIIa.

Conclusions: The MTP resulted in a reduction in the use of blood components with improved turnaround times and significant savings. Mortality was unaffected. The use of recombinant factor VIIa did not increase thromboembolic complications in these patients.

Arch Surg. 2008;143(7):686-691

Table 3. Differences in Units of Blood Component Transfused Between Groups

Component	Pre-MTP[a]	MTP[a]	*P* Value
PRBCs	15.5 (15.5)	11.8 (11.8)	<.001
Thawed plasma	8.7 (6.9)	5.7 (5.4)	<.02
Platelets	3.8 (5.2)	1.1 (1.3)	<.001
Cryoprecipitate	0.7 (0.9)	0.6 (0.8)	.32
rFVIIa, mg	0.63 (1.8)	1.91 (2.5)	<.002

Abbreviations: MTP, massive transfusion protocol; PRBCs, packed red blood cells; rFVIIa, recombinant factor VIIa.

[a] Data are given as mean (SD).

Massive Transfusion Protocols: The Role of Aggressive Resuscitation Versus Product Ratio in Mortality Reduction

Daniel J Riskin, MD, MBA, Thomas C Tsai, BS, Loren Riskin, MD, Tina Hernandez-Boussard, PhD, MPH, Maryanne Purtill, MD, Paul M Maggio, MD, MBA, FACS, David A Spain, MD, FACS, Susan I Brundage, MD, MPH, FACS

J Am Coll Surg 2009

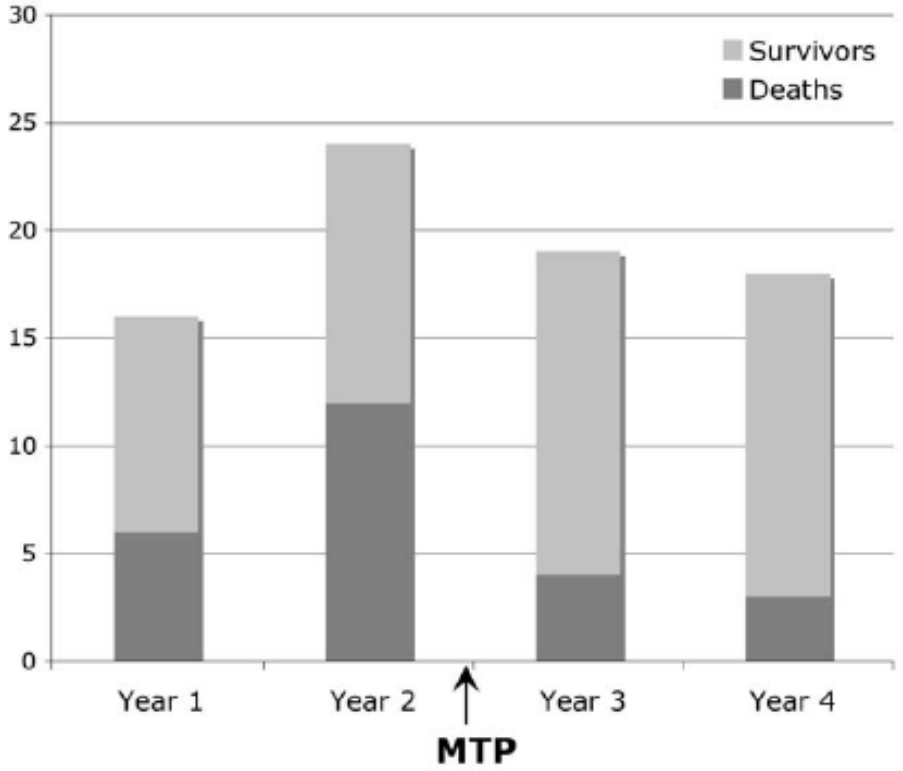


Figure 2. Patient survival by year. MTP, massive transfusion protocol.

Table 4. Mortality Rates Between Cohorts

Variable	Pre-MTP	Post-MTP	p Value
Patients, n	40	37	
Deaths, n	18	7	
Mortality, %	45	19	0.02*

Predefined Massive Transfusion Protocols are Associated With a Reduction in Organ Failure and Postinjury Complications

Bryan A. Cotton, MD, Brigham K. Au, BS, Timothy C. Nunez, MD, Oliver L. Gunter, MD, Amy M. Robertson, MD, and Pampee P. Young, MD, PhD

Introduction: Massive transfusion (MT) protocols have been shown to improve survival in severely injured patients. However, others have noted that these higher fresh frozen plasma (FFP): red blood cell (RBC) ratios are associated with increased risk of organ failure. The purpose of this study was to determine whether MT protocols are associated with increased organ failure and complications.

Methods: Our institution's exsanguination protocol (TEP) involves the immediate delivery of products in a 3:2 ratio of RBC:FFP and 5:1 for RBC:platelets. All patients receiving TEP between February 2006 and January 2008 were compared with a cohort (pre-TEP) of all patients from February 2004 to January 2006 that (1) went immediately to the operating room and (2) received MT (≥10 units of RBC in first 24 hours).

Results: Two hundred sixty-four patients met inclusion (125 in the TEP group, 141 in the pre-TEP). Demographics and Injury Severity Score were similar. TEP received more intraoperative FFP and platelets but less in first 24 hours ($p < 0.01$). There was no difference in renal failure or systemic inflammatory response syndrome, but pneumonia, pulmonary failure, open abdomens, and abdominal compartment syndrome were lower in TEP. In addition, severe sepsis or septic shock and multiorgan failure were both lower in the TEP patients (9% vs. 20%, $p = 0.011$ and 16% vs. 37%, $p < 0.001$, respectively).

Conclusions: Although MT has been associated with higher organ failure and complication rates, this risk appears to be reduced when blood products are delivered early in the resuscitation through a predefined protocol. Our institution's TEP was associated with a reduction in multiorgan failure and infectious complications, as well as an increase in ventilator-free days. In addition, implementation of this protocol was followed by a dramatic reduction in development of abdominal compartment syndrome and the incidence of open abdomens.

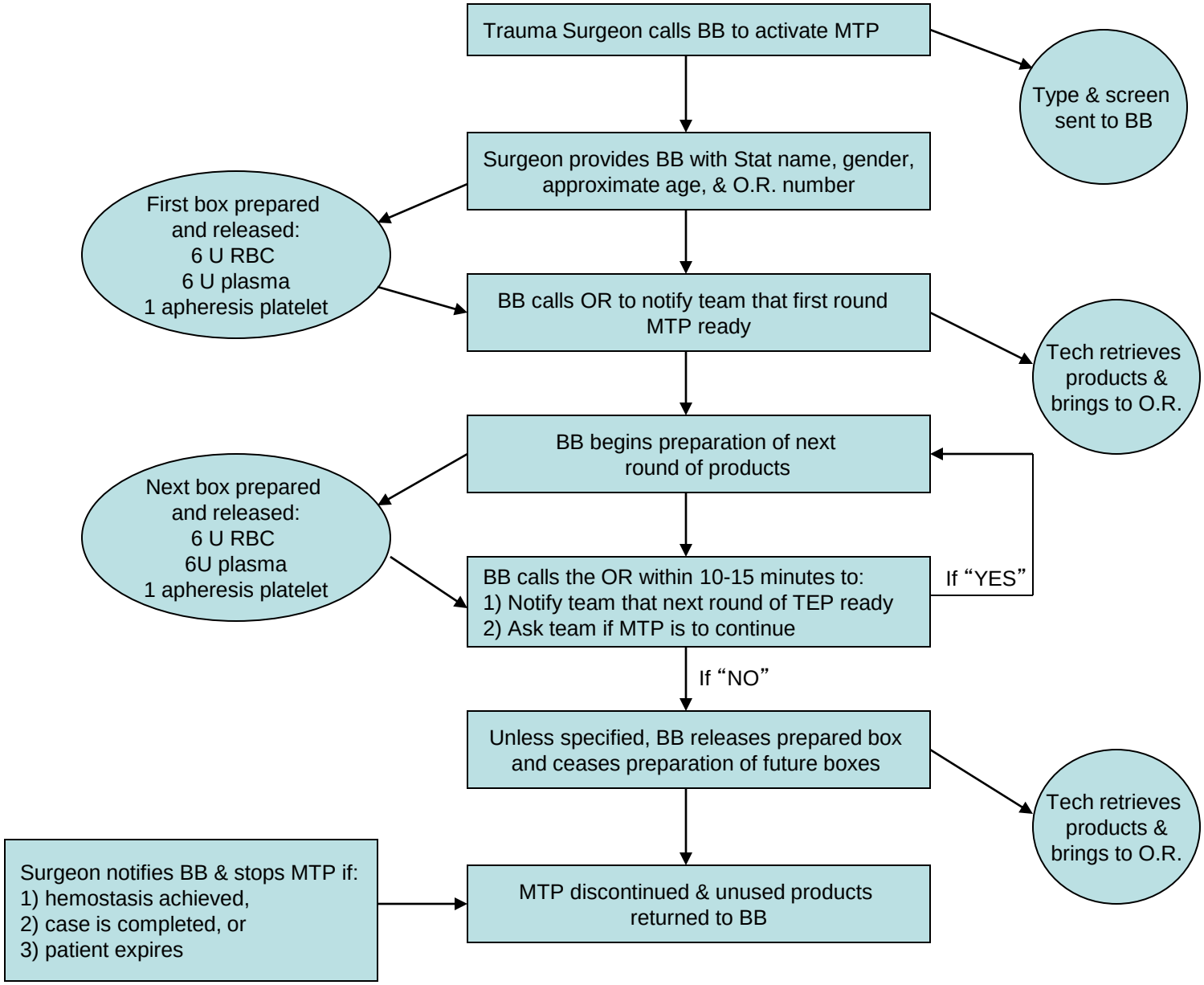
Key Words: Hemorrhage, Exsanguination, Trauma, Massive transfusion.

J Trauma. 2009;66:000–000.

Reduce transfusions…reduce exposure… reduce complications

The protocol

- Should be a written document, accessible to all, and adopted by the center.
- Anyone who “touches” the MTP should be involved with development and oversight.
- Provide for ratio based blood products, empirically delivered.
- Standardization of coagulation assessment, plans to treat acidosis, hypothermia, hypoCa+.

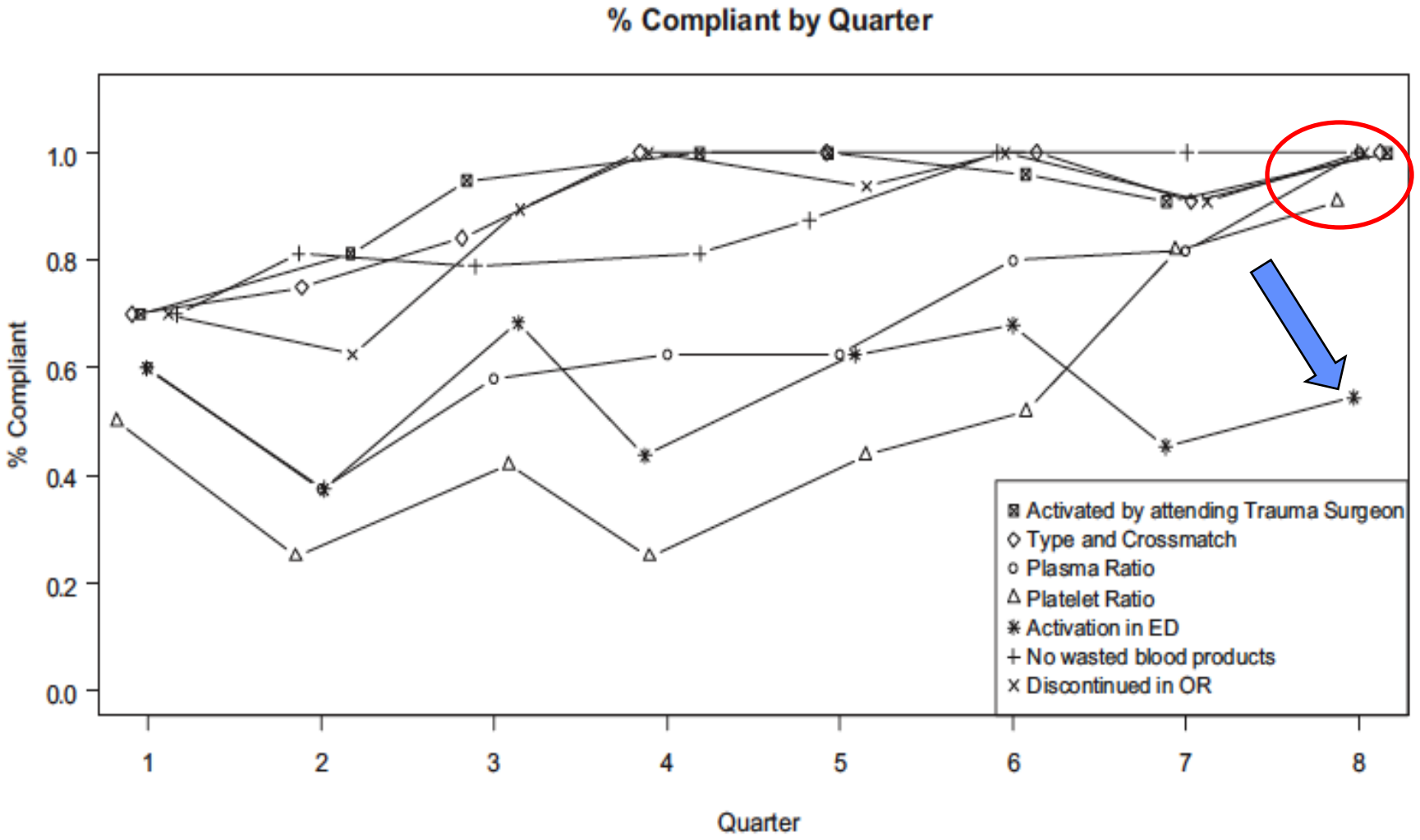

Trauma Surgeon calls BB to activate MTP
Type & screen sent to BB
Surgeon provides BB with Stat name, gender, approximate age, & O.R. number
First box prepared and released: 6 U RBC 6 U plasma 1 apheresis platelet
BB calls OR to notify team that first round MTP ready
Tech retrieves products & brings to O.R.
BB begins preparation of next round of products
Next box prepared and released: 6 U RBC 6U plasma 1 apheresis platelet
BB calls the OR within 10-15 minutes to: 1) Notify team that next round of TEP ready 2) Ask team if MTP is to continue
If "YES"
If "NO"
Unless specified, BB releases prepared box and ceases preparation of future boxes
Tech retrieves products & brings to O.R.
Surgeon notifies BB & stops MTP if: 1) hemostasis achieved, 2) case is completed, or 3) patient expires
MTP discontinued & unused products returned to BB

Predicting need for MTP

- Predicting the need for MT is difficult.
- Mortality is improved with rapid implementation of appropriate MT guidelines but complications are increased if patients have unnecessary exposure to blood products.
- Prediction tools have been developed for both military and civilian trauma patients, with specificities that range between 80% and 90%.

TABLE 7. Unadjusted and Adjusted ORs for 30-d Survival by Individual PI Measure Compliance

Variable	Crude OR	95% CI	Adjusted OR	95% CI
ED protocol activation	3.44	1.927–6.157	2.79	1.039–7.497
Plasma:RBC ratio of 2:3	6.91	3.797–12.556	12.28	3.860–39.069
Platelet:RBC ratio of 1:5	7.78	3.814–15.871	3.72	1.392–9.975
Trauma attending activation	2.30	1.402–3.778	0.895	0.960–8.337
ED type and screen sent	2.15	1.315–3.539	0.195	0.023–1.621
Age (yr)	0.98	0.968–0.997	0.98	0.957–1.015
Male	1.12	0.841–1.500	0.75	0.264–2.157
ISS	0.98	0.963–0.0997	0.96	0.941–1.357


% Compliant by Quarter
% Compliant
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
8
Quarter
Activated by attending Trauma Surgeon
Type and Crossmatch
Plasma Ratio
Platelet Ratio
Activation in ED
No wasted blood products
Discontinued in OR

Available scoring systems

	ABC[7]	TASH[14]	Schreiber[22]	McLaughlin[11]	ETS[21]	PWH[27]
Age					X	
Penetrating mechanism	X		X			
Tachycardia	X	X				X
Hypotension	X	X			X	X
(+) FAST	X	X				X
pH value				X		
Base deficit		X				X
PT/INR			X			
Hemoglobin/hematocrit		X	X	X		X
Pelvic fracture		X			X	X
GCS						X

ABC Score

- Four (4) dichotomous components available during the “A-B-C’ s”

- The presence of any one component contributes one point to the total score (range 0-4)
- Parameters: Penetrating MOI (0=no, 1=yes), ED SBP ≤ 90mmHg (0=no, 1=yes), ED HR ≥120 bpm (0=no, 1=yes), (+) FAST (0=no, 1=yes)

Early Prediction of Massive Transfusion in Trauma: Simple as ABC?

Timothy C. Nunez, MD, Igor V. Voskresensky, MD, Lesly A. Dossett, MD, MPH, Ricky Shinall, BS, William D. Dutton, MD, and Bryan A. Cotton, MD

Background: Massive transfusion (MT) occurs in about 3% of civilian and 8% of military trauma patients. Although many centers have implemented MT protocols, most do not have a standardized initiation policy. The purpose of this study was to validate previously described MT scoring systems and compare these to a simplified nonlaboratory dependent scoring system (Assessment of Blood Consumption [ABC] score).

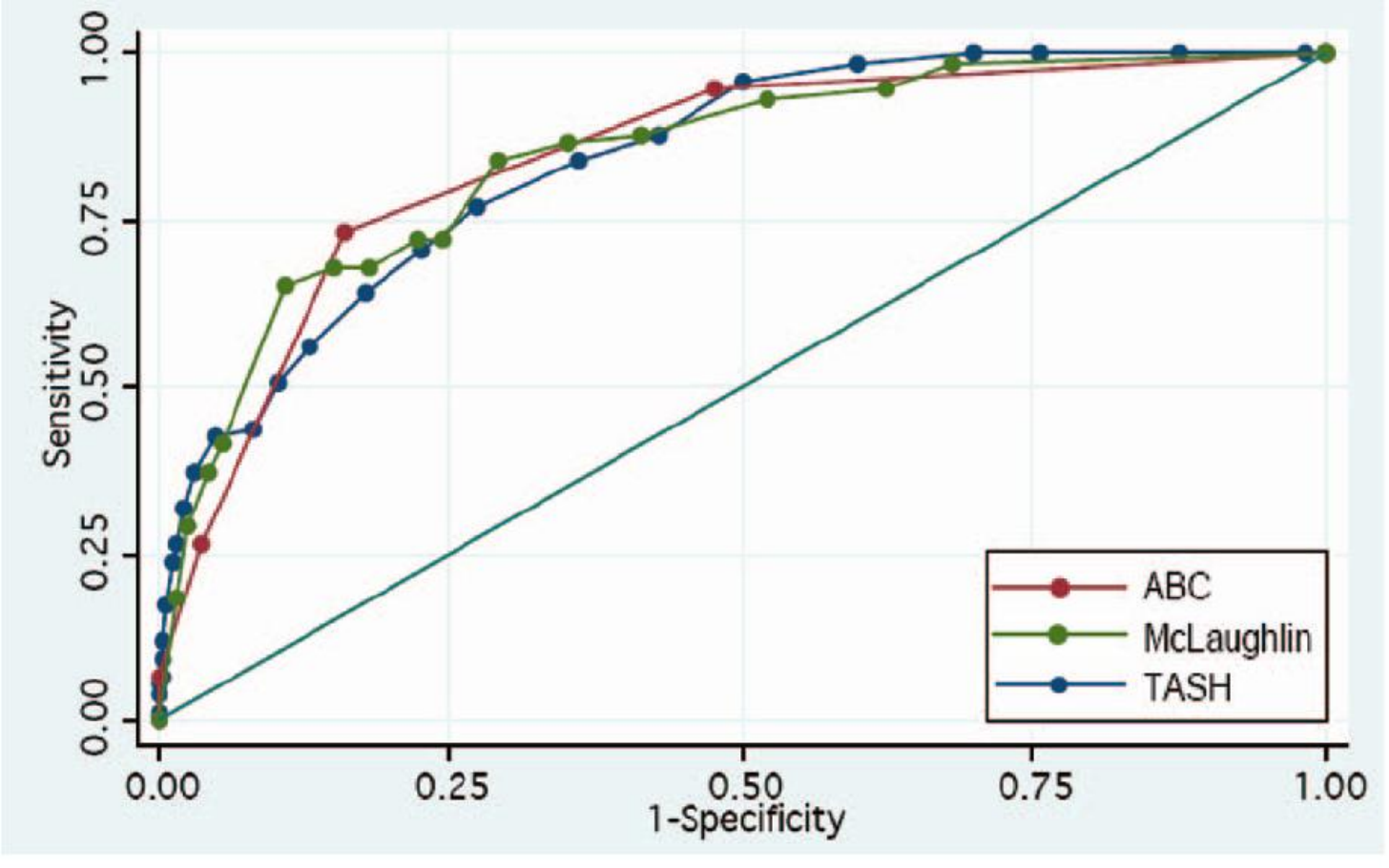
Methods: Retrospective cohort of all level I adult trauma patients transported directly from the scene (July 2005 to June 2006). Trauma-Associated Severe Hemorrhage (TASH) and McLaughlin scores calculated according to published methods. ABC score was assigned based on four nonweighted parameters: penetrating mechanism, positive focused assessment sonography for trauma, arrival systolic blood pressure of 90 mm Hg or less, and arrival heart rate ≥120 bpm. Area under the receiver operating characteristic curve (AUROC) used to compare scoring systems.

Results: Five hundred ninety-six patients were available for analysis; and the overall MT rate of 12.4%. Patients receiving MT had higher TASH (median, 6 vs. 13; $p < 0.001$), McLaughlin (median, 2.4 vs. 3.4; $p < 0.001$) and ABC (median, 1 vs. 2; $p < 0.001$) scores. TASH (AUROC = 0.842), McLaughlin (AUROC = 0.846), and ABC (AUROC = 0.842) scores were all good predictors of MT, and the difference between the scores was not statistically significant. ABC score of 2 or greater was 75% sensitive and 86% specific for predicting MT (correctly classified 85%).

Conclusions: The ABC score, which uses nonlaboratory, nonweighted parameters, is a simple and accurate in identifying patients who will require MT as compared with those previously published scores.

Key Words: Hemorrhage, Trauma, Massive transfusion, Prediction, Scoring systems.

ABC vs. McLaughlin vs. TASH

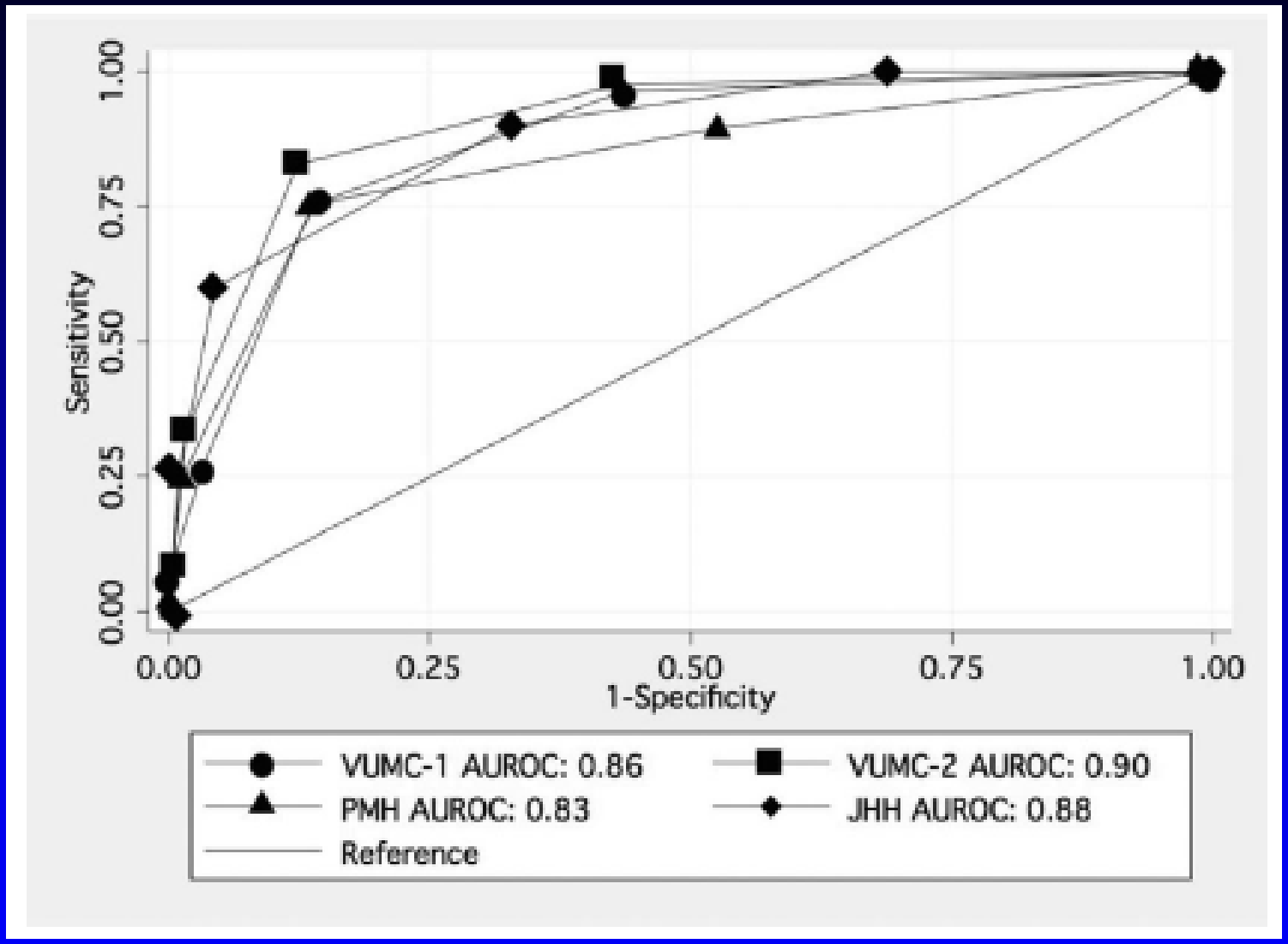


ORIGINAL ARTICLE

Multicenter Validation of a Simplified Score to Predict Massive Transfusion in Trauma

Bryan A. Cotton, MD, MPH, Lesly A. Dossett, MD, MPH, Elliott R. Haut, MD, Shahid Shafi, MD, MPH, Timothy C. Nunez, MD, Brigham K. Au, MD, Victor Zaydfudim, MD, MPH, Marla Johnston, RN, MSN, Patrick Arbogast, PhD, and Pampee P. Young, MD, PhD

J Trauma 2010


Sensitivity
0.00
0.25
0.50
0.75
1.00
1-Specificity
0.00
0.25
0.50
0.75
1.00
VUMC-1 AUROC: 0.86
VUMC-2 AUROC: 0.90
PMH AUROC: 0.83
JHH AUROC: 0.88
Reference

Comparison of massive blood transfusion predictive models in the rural setting

Nicole J. Krumrei, MD, Myung S. Park, MD, Bryan A. Cotton, MD, MPH, *and* **Martin D. Zielinski, MD,**
Rochester, Minnesota

BACKGROUND: Hemorrhage is the leading cause of preventable death in trauma patients, of which 3% require massive transfusion (MT). MT predictive models such as the Assessment of Blood Consumption (ABC), Trauma-Associated Severe Hemorrhage (TASH), and McLaughlin scores have been developed, but only included patients requiring blood transfusion during their hospital stay, excluding a large percentage of trauma patients. Our purpose was to validate these MT predictive models in our rural Level I trauma center patient population, using all major trauma victims, regardless of blood product requirements.

METHODS: Review of all Level I trauma patients admitted in 2008 to 2009 was performed. ABC, TASH, and McLaughlin scores were calculated using 80% probability for the need for MT.

RESULTS: Three hundred seventy-three patients were admitted; 13% had a penetrating mechanism and 52% were scene transports. MT patients had higher Injury Severity Score (median, 43 vs. 13; $p < 0.001$) and lower Trauma-Injury Severity Score (0.310 vs. 0.983; $p < 0.001$). Mortality was higher in MT patients (18.4% vs. 5.4%; $p < 0.009$). Thirty-eight (10%) required MT; 34 were predicted by ABC, one by TASH, and six by McLaughlin. ABC (area under the receiver operating characteristic [AUROC] = 0.86) was predictive of MT, whereas TASH (AUROC = 0.51) and McLaughlin (AUROC = 0.56) were not.

CONCLUSIONS: The ABC score correctly identified 89% of MT patients and was predictive of MT in major trauma patients at our rural Level I trauma center; the TASH and McLaughlin scores were not. The ABC score is simpler, faster, and more accurate. Based on this work, we strongly recommend adoption of the ABC score for MT prediction. (*J Trauma.* 2012;72: 211–215. Copyright © 2012 by Lippincott Williams & Wilkins)

LEVEL OF EVIDENCE: III.

KEY WORDS: Massive blood transfusion; trauma; rural trauma; trauma systems; prediction model.

J Trauma
Volume 72, Number 1

Activation of the MTP

- ABC over triage rate is high (PPV 50-55%)
- Under-triage rate <5% (NPV 95-97%).
- You can always send the cooler back, but you can't make it quicker when you're wrong.
- Other scores have been developed and all include the presence of severe tissue injury and hemorrhagic shock as important risk factors

A Randomized Controlled Pilot Trial of Modified Whole Blood Versus Component Therapy in Severely Injured Patients Requiring Large Volume Transfusions

Bryan A. Cotton, MD, MPH,† Jeanette Podbielski, BSN,† Elizabeth Camp, MSPH,† Timothy Welch, NREMT-P,† Deborah del Junco, PhD,† Yu Bai, MD, PhD,‡ Rhonda Hobbs, MT (ASCP),‡ Jamie Scroggins, MT (ASCP),§ Beth Hartwell, MD,§ Rosemary A. Kozar, MD, PhD,* Charles E. Wade, PhD,*† and John B. Holcomb, MD*† on behalf of The Early Whole Blood Investigators*

PROPPR

Pragmatic, **R**andomized **O**ptimal **P**latelet and **P**lasma **R**atios

CeTR

Trauma bay, OR, and IR

- Universal RBC (O-/+) and thawed AB plasma immediately available, ideally stored in ED.
- Centers using thawed plasma early in resus have seen reductions in blood product use.
- If unable to provide adequate stores of AB plasma, low (anti-B) titer A plasma may be utilized (or liquid plasma).

ORIGINAL ARTICLE

An Emergency Department Thawed Plasma Protocol for Severely Injured Patients

Zayde A. Radwan, BS; Yu Bai, MD, PhD; Nena Matijevic, PhD, PharmD; Deborah J. del Junco, PhD; James J. McCarthy, MD; Charles E. Wade, PhD; John B. Holcomb, MD; Bryan A. Cotton, MD, MPH

Importance: In an effort to expedite delivery of plasma for patients requiring massive transfusions, US medical centers began keeping thawed plasma (TP) in their blood banks (BBs), markedly reducing time to release of plasma; however, the time to transfusion was still excessively long.

Objective: To expedite delivery and transfusion of TP through implementation of an emergency department (ED) protocol.

Design and Setting: Retrospective cohort study in an American College of Surgeons–verified level I trauma center.

Participants: Using the Trauma Registry of the American College of Surgeons database, we evaluated all adult trauma patients admitted from June 1, 2009, through August 31, 2010, who arrived directly from the scene, were the institution's highest level trauma activation, and received at least 1 U of red blood cells and 1 U of plasma in the first 6 hours after admission. The protocol was initiated in February 2010 by giving 4 U of AB plasma to patients in the ED. Patients were then divided into 2 groups: those admitted 8 months before (TP-BB) and 8 months after implementing TP location change (TP-ED).

Main Outcome Measures: Primary outcome was time to first unit of plasma. Secondary outcomes included 24-hour blood use and 24-hour and 30-day mortality.

Results: A total of 294 patients met the study criteria (130 in the TP-BB group and 164 in the TP-ED). Although the patient demographics were similar, TP-ED patients had greater anatomical injury (median Injury Severity Score, 18 vs 25; $P=.02$) and more physiologic disturbances (median weighted Revised Trauma Score, 6.81 vs 3.83; $P=.008$). The TP-ED patients had a shorter time to first plasma transfusion (89 vs 43 minutes, $P<.001$). The TP-ED protocol was associated with a reduction in 24-hour transfusion of RBCs ($P=.04$), plasma ($P=.04$), and platelets ($P<.001$). Logistic regression identified TP-ED as an independent predictor of decreased 30-day mortality (odds ratio, 0.43; 95% CI, 0.194-0.956; $P=.04$).

Conclusions: We demonstrated that implementation of an ED-TP protocol expedites transfusion of plasma to severely injured patients. This approach is associated with a reduction in overall blood product use and a 60% decreased odds in 30-day mortality.

JAMA Surg. 2013;148(2):170-175

Trauma bay, OR, and IR

- To avoid “popping the clot,” DCR principles suggest RBC/plasma be delivered by rapid infuser/warmer.
- Initial rate of transfusion should restore perfusion but allow for permissive hypotension until operation to stop the bleeding has begun.
- Platelets and cryoprecipitate should not be administered through a blood warmer.

ORIGINAL ARTICLE

Hypotensive Resuscitation Strategy Reduces Transfusion Requirements and Severe Postoperative Coagulopathy in Trauma Patients With Hemorrhagic Shock: Preliminary Results of a Randomized Controlled Trial

C. Anne Morrison, MD, MPH, Matthew M. Carrick, MD, Michael A. Norman, MD, Bradford G. Scott, MD, Francis J. Welsh, MD, Peter Tsai, MD, Kathleen R. Liscum, MD, Matthew J. Wall, Jr., MD, and Kenneth L. Mattox, MD

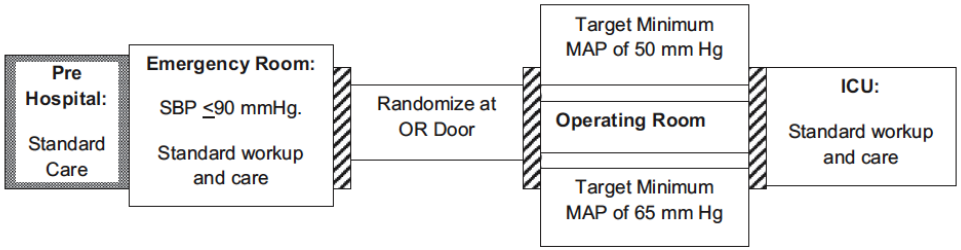
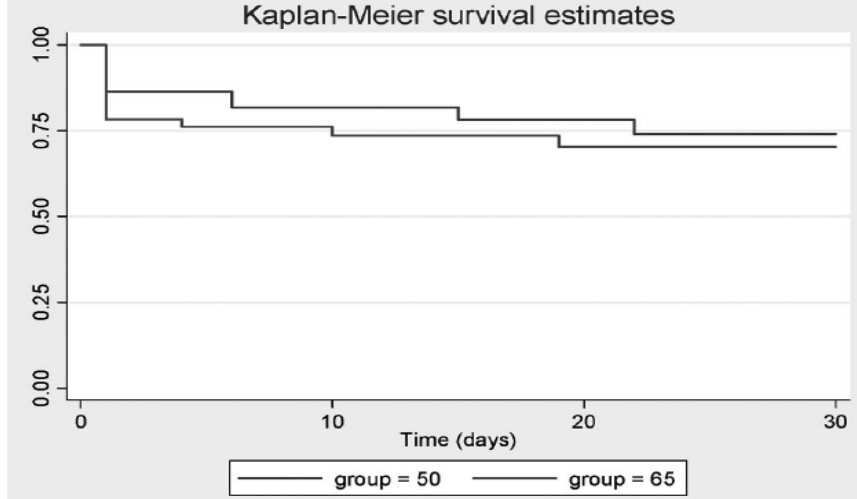


Figure 1. Diagram of the patient flow from left to right.

TABLE 6. Intraoperative Fluids

	MAP = 50 mm Hg				MAP = 65 mm Hg				
	n	Mean	SD	CI	n	Mean	SD	CI	*p*
IVF									
Crystalloid (mL)	44	2,883	1,921	2,299–3,467	46	3,282	2,010	2,667–3,866	0.34
Colloid (mL)	44	512	469	367–656	46	609	470	469–748	0.33
Blood products									
PRBC (mL)	44	1,335	1,812	784–1,886	46	2,244	2,466	1,512–2,977	0.05
FFP (mL)	44	198	471	54–341	46	528	860	272–783	0.02
Platelets (mL)	44	61	214	3–137	46	114	242	42–186	0.27
Total inputs									
Non-blood products (mL)	44	3,438	2,103	2,791–4,086	46	3,875	2,098	3,252–4,498	0.33
Blood products (mL)	44	1,594	2,292	897–2,291	46	2,898	3,299	1,918–3,877	0.03
Total fluids	44	3,070	3,631	3,952–6,187	46	6,762	4,559	5,408–8,116	0.06
Total outputs									
Estimated blood loss (mL)	44	1,964	2,215	1,290–2,637	46	3,008	2,948	2,132–3,883	0.06
Urine output (mL)	40	272	284	181–363	40	347	353	234–460	0.29
Total fluid balance	40	3,026	2,470	2,225–3,826	40	3,089	2,383	2,327–3,851	0.90



Goals of early resuscitation in Trauma bay, OR, and IR

- Transfuse universal products in a ratio between 1:1 and 1:2 (plasma to RBC) at 100 mL/min.
- Transfuse one bag of platelets/ 6 units RBC.
- Products should be automatically sent by BB within 15 minutes of MTP activation.
- Subsequent coolers should be delivered at 15 minute intervals until MTP terminated.

Goals of early resuscitation in Trauma bay, OR, and IR

- In OR/IR, rapid delivery and transfusion should continue (at set ratios) and at a rate to keep the patient euvolemic while actively bleeding.

- Once major bleeding controlled and transfusion rate slowed, appropriate to switch to lab or point of care (POC)-based transfusion.

Radwan ZA et al. JAMA Surg
Zielinski MD et al. J Trauma Acute Care Surg
Armand R and Hess JR. Transfus Med Rev. 2003

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ICU resuscitation

- MT=ICU admission
- ICU team should anticipate arrival of these patients with the necessary equipment and personnel to care for these patients.
- However, ongoing bleeding and RAPID transfusion should return to OR
- Priorities: correct coagulopathy and associated issues (hypothermia, acidosis, hypocalcemia)

ICU resuscitation

- ICU driven algorithm should be optimized to use blood components for goal directed therapy.
- Hgb 8-10 g/dL (rheologic, facilitate clotting)
- Upon arrival, baseline labs, repeat frequently until defects corrected (coags, TEG, iCa, abg)
- Once results available, goal directed resus

Royston D et al. Br J Anaesth. 2001
Holcomb JB et al. Ann Surg 2012
Ak K et al. J Card Surg, 2009

Transfusion Services

- Designated trauma centers should have on-site Transfusion Service, operating 24/7, with SOP for immediate, continuous delivery of products.
- Timely, precise communication between trauma team, ED, OR, anesthesia and BB is critical.
- Most efficient way to immediately provide products is with refrigerator in resuscitation bay.
- Rapid delivery of coolers from BB is best accomplished through a dedicated runner.

Dutton RP et al. J Trauma 2005
Armand R and Hess JR. Transfus Med Rev 2003
Quillen K et al Transfusion 2011

CeTR

Transfusion Services

- Liquid or thawed plasma immediately available.
- AB ideal universal plasma, but only 4% donors.
- However, 40% donors A, many are low anti-B titers; can be safely given to almost everyone.
- Switch to group specific plasma ASAP (10 min).
- Upon termination of MTP, PROMPT return of all remaining blood products and coolers to BB.


UNCROSSMATCHED
Removed from refrigerator:
Date
Time
UNCROSSMATCHED
Removed from refrigerator:
Date
Time
UNCROSSMATCHED
Removed from refrigerator:
Date
Time
UNCROSSMATCHED
Removed from refrigerator:
Date
Time
UNCROSSMATCHED
RED BLOOD CELLS
ADENINE – SALINE (AS – 1) ADDED
LEUKOCYTES REDUCED

Emergency use of prethawed Group A plasma in trauma patients

Martin D. Zielinski, MD, Pamela M. Johnson, MD, Donald Jenkins, MD, Naeem Goussous, MD, *and* James R. Stubbs, MD, *Rochester, Minnesota*

BACKGROUND: Massive transfusion protocols lead to increased use of the rare universal plasma donor, Type AB, potentially limiting supply. Owing to safety data, with a goal of avoiding shortages, our blood bank exploited Group A rather than AB for all emergency release plasma transfusions. We hypothesized that ABO-incompatible plasma transfusions had mortality similar to ABO-compatible transfusions.

METHODS: Review of all trauma patients receiving emergency release plasma (Group A) from 2008 to 2011 was performed. ABO compatibility was determined post hoc. Deaths before blood typing were eliminated. $p < 0.05$ was considered statistically significant.

RESULTS: Of the 254 patients, 35 (14%) received ABO-incompatible and 219 (86%) received ABO-compatible transfusions. There was no difference in age (56 years vs. 59 years), sex (63% vs. 63% male), Injury Severity Score (ISS) (25 vs. 22), or time spent in the trauma bay (24 vs. 26.5 minutes). Median blood product units transfused were similar: emergency release plasma (2 vs. 2), total plasma at 24 hours (6 vs. 4), total red blood cells at 24 hours (5 vs. 4), plasma–red blood cells at 24 hours (1.3:1 vs. 1.1:1), and plasma deficits at 24 hours (2 vs. 1). Overall complications were similar (43% vs. 35%) as were rates of possible transfusion-related acute lung injury (2.9% vs. 1.8%), acute lung injury (3.7% vs. 2.5%), adult respiratory distress syndrome (2.9% vs. 1.8%), deep venous thrombosis (2.9% vs. 4.1%), pulmonary embolism (5.8% vs. 7.3%), and death (20% vs. 22%). Ventilator (6 vs. 3), intensive care unit (4 vs. 3), and hospital days (9 vs. 7) were similar. There were no hemolytic reactions. Mortality was significantly greater for the patients who received incompatible plasma if concurrent with a massive transfusion (8% vs. 40%, $p = 0.044$). Group AB plasma use was decreased by 96.6%.

CONCLUSION: Use of Group A for emergency release plasma resulted in ABO-incompatible transfusions; however, this had little effect on clinical outcomes. Blood banks reticent to adopt massive transfusion protocols owing to supply concerns may safely use plasma Group A, expanding the pool of emergency release plasma donors. (*J Trauma Acute Care Surg*. 2013;74: 69–75.

LEVEL OF EVIDENCE: Therapeutic study, level IV; prognostic study, level III.

KEY WORDS: Hemostatic resuscitation; plasma; transfusion; blood products; ABO compatibility.

End-points of transfusion

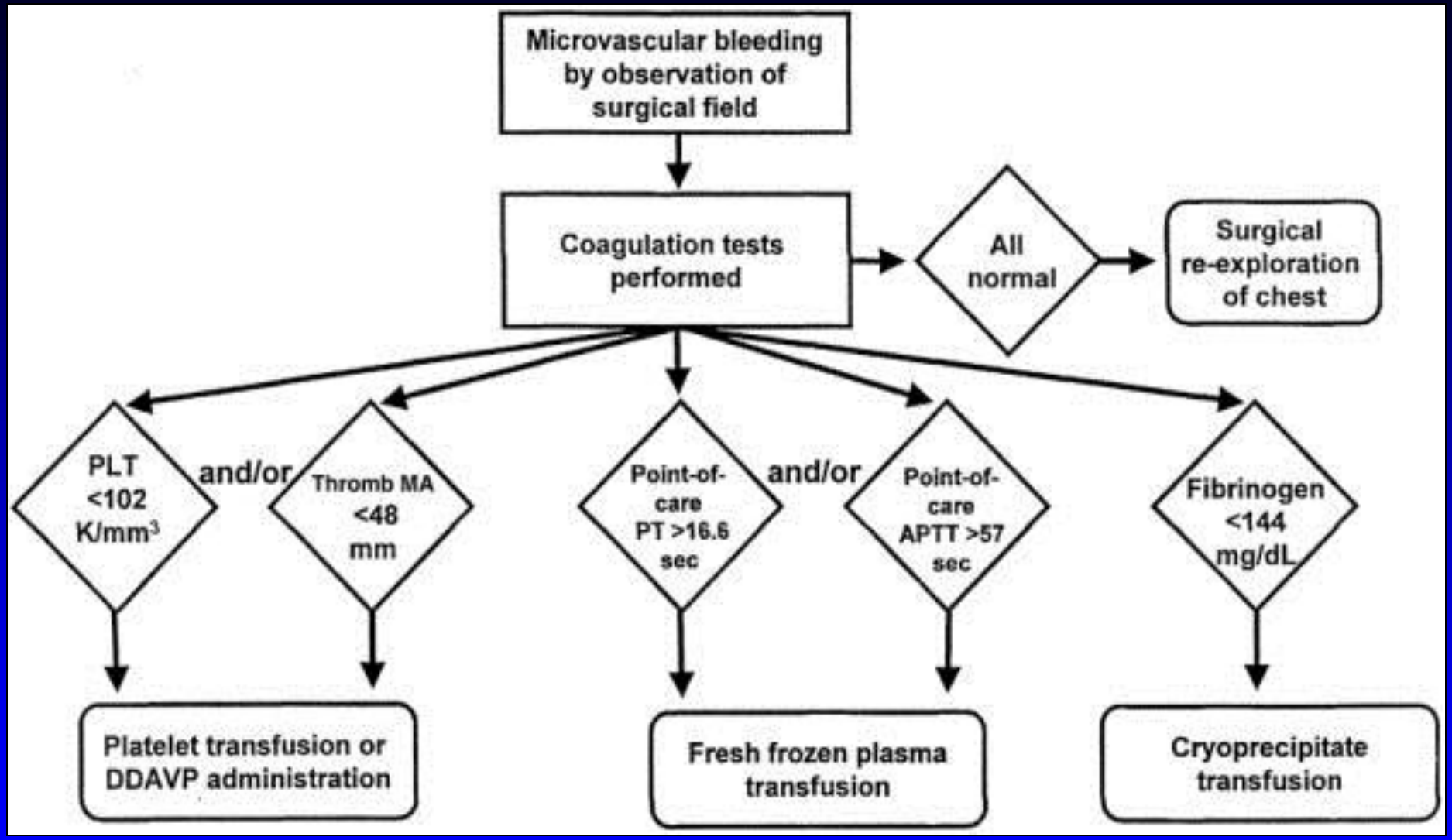
- Criteria for stopping MTP should include both anatomic (control of bleeding) and physiologic criteria (normalizing hemodynamic status).

- Decision to stop should be made by surgeon and anesthesiologist, if still in OR, or the intensivist/ trauma surgeon if in the ICU.

- Specific lab endpoints used to guide further resus should be based on data and clinical experience of those caring for the patient.

TABLE 7. Current Memorial Hermann Hospital Transfusion Recommendations Based on Abnormal r-TEG Values in Bleeding Patients

Laboratory Values	Blood Product Transfusion
ACT > 128	Plasma and RBCs
r-value > 1.1	Plasma and RBCs
k-time > 2.5	Cryoprecipitate / fibrinogen / plasma
α-angle < 56	Cryoprecipitate / fibrinogen / platelets
MA < 55	Platelets / cryoprecipitate / fibrinogen
LY30 > 3%	Tranexamic acid
PT > 18.0	Plasma
aPTT > 35	Plasma
INR >1.5	Plasma
Platelet count < 150×10^9/L	Platelets
Fibrinogen < 180 g/L	Cryoprecipitate / fibrinogen


Microvascular bleeding by observation of surgical field
Coagulation tests performed
All normal
Surgical re-exploration of chest
PLT <102 K/mm3
and/or
Thromb MA <48 mm
Point-of-care PT >16.6 sec
and/or
Point-of-care APTT >57 sec
Fibrinogen <144 mg/dL
Platelet transfusion or DDAVP administration
Fresh frozen plasma transfusion
Cryoprecipitate transfusion

PAPERS OF THE 132ND ASA ANNUAL MEETING

Admission Rapid Thrombelastography Can Replace Conventional Coagulation Tests in the Emergency Department

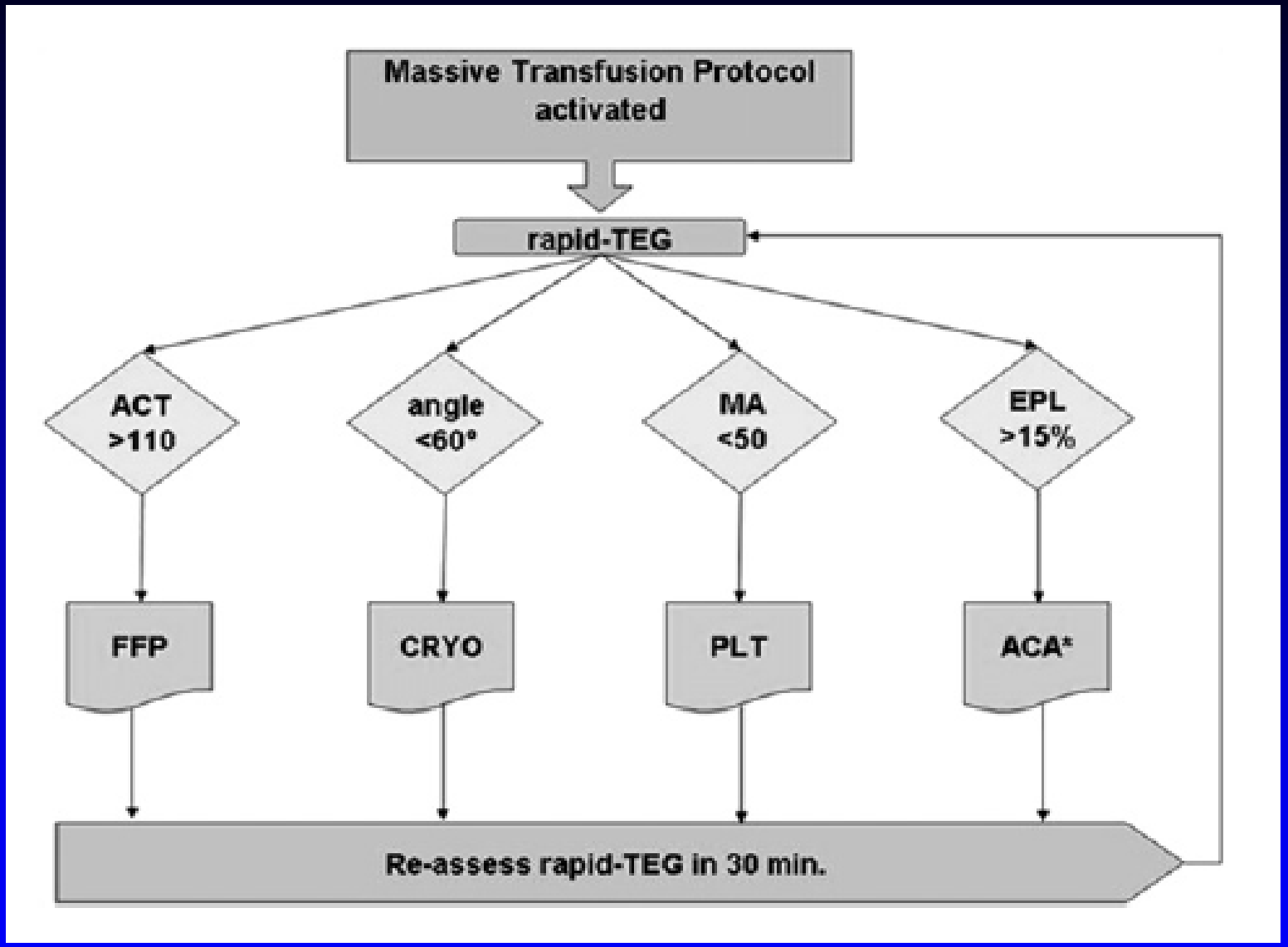
Experience With 1974 Consecutive Trauma Patients

John B. Holcomb, MD, Kristin M. Minei, BS, Michelle L. Scerbo, BS, Zayde A. Radwan, BS, Charles E. Wade, PhD, Rosemary A. Kozar, MD, PhD, Brijesh S. Gill, MD, Rondel Albarado, MD, Michelle K. McNutt, MD, Saleem Khan, MD, Phillip R. Adams, MD, James J. McCarthy, MD, and Bryan A. Cotton, MD, MPH

***Ann Surg* 2012**

Admission Rapid Thrombelastography Can Replace Conventional Coagulation Tests in the Emergency Department

ACT > 128	**Transfuse plasma and RBC**
r-value > 1.1	**Transfuse plasma and RBC**
k-time > 2.5	**Transfuse plasma** **Add cryoprecipitate/fibrinogen if angle also abnormal**
α-angle < 56	**Transfuse cryoprecipitate (or fibrinogen)** **Add platelets if mA is also abnormal**
MA < 55	**Transfuse platelets** **Add cryoprecipitate/fibrinogen if angle also abnormal**
LY-30 > 3%	**Administer tranexamic acid or amino-caproic acid**



Pezold et al Sugery 2011

Reviewing your MTP

- You have to live to have a complication!
- Review hemorrhage/transfusion complications
- Review availability and management of blood products during MTP.
- Review MTP cases with the following complications: coagulopathy on ICU arrival, thrombotic cx, ARDS, TACO/TRALI, death

Reviewing your MTP

- Performance indicators for the process of massive transfusion should include:
  - * Time from calling MTP to 1st unit RBC
  - * Time from calling MTP to 1st unit plasma
  - * Adherence to pre-determined ratios
  - * Informing BB when MTP terminated
  - * Wastage/mishandling blood products

Room for (Performance) Improvement: Provider-Related Factors Associated With Poor Outcomes in Massive Transfusion

Bryan A. Cotton, MD, MPH, Lesly A. Dossett, MD, MPH, Brigham K. Au, BS, Timothy C. Nunez, MD, Amy M. Robertson, MD, and Pampee P. Young, MD, PhD

Background: Massive transfusion (MT) protocols improve survival in patients with exsanguinating hemorrhage. Both the increased plasma to red blood cells (RBC) and platelets to RBC ratios, and the "protocolization" of product delivery seem to be critical components of the reduction in mortality. The purpose of this study was to identify the incidence and impact of MT protocol noncompliance and to intervene in provider-related events associated with poor compliance and outcomes.

Methods: A MT protocol was initiated in 2006 at a Level I trauma center. All cases of protocol activation were reviewed by a multidisciplinary performance improvement (PI) group for compliance and the need for "real-time" protocol adjustments. Educational conferences, Grand Rounds presentations, and individual provider education were performed on a quarterly basis. Compliance of seven measures were evaluated as follows: type and screen sent from emergency department (ED), activation of protocol in ED, activation by trauma attending, administration of 2:3 plasma to RBC, administration of 1:5 platelets to RBC, protocol discontinuation on leaving operating room, and no products wasted. Univariate, multivariate, and time-series analyses were performed.

Results: All 125 MT protocol activations occurring from February 2006 to January 2008 were reviewed. Full compliance for all PI measures during the entire period was 27%. There were no differences in demographics, injury severity, or physiologic scores between patients for whom activations were compliant and those who were noncompliant. Full compliance was an independent predictor of survival (86.7% vs. 45.0%, $p < 0.001$). Both activation of the protocol in the ED and achievement of prespecified ratios of plasma: RBC (2:3) and platelets: RBC (1:5) were independent predictors of 24-hour and 30-day survivals. All PI measures demonstrated improved compliance during the study period with the exception of ED activation. Failure to send type and screen from the ED is an independent predictor of wasted blood products.

Conclusion: Early activation of a MT protocol and achieving predefined ratios was associated with improved survival. ED activation and direct blood bank notification by the trauma attending were associated with a reduction in blood product wastage. A multidisciplinary PI process helps to identify provider/specialty noncompliance and to assess the impact of these factors,

TABLE 1. TEP PI/QI Audit Filters

Activated by the attending trauma surgeon
A type and screen sample is sent from the ED
PRBC and plasma are administered in a ratio of 3:2
PRBC and platelets are administered in a ratio of 5:1
Blood products are received from the blood bank in a timely fashion
Unused blood products are appropriately stored
The TEP is deactivated when the risk of active exsanguinations has passed

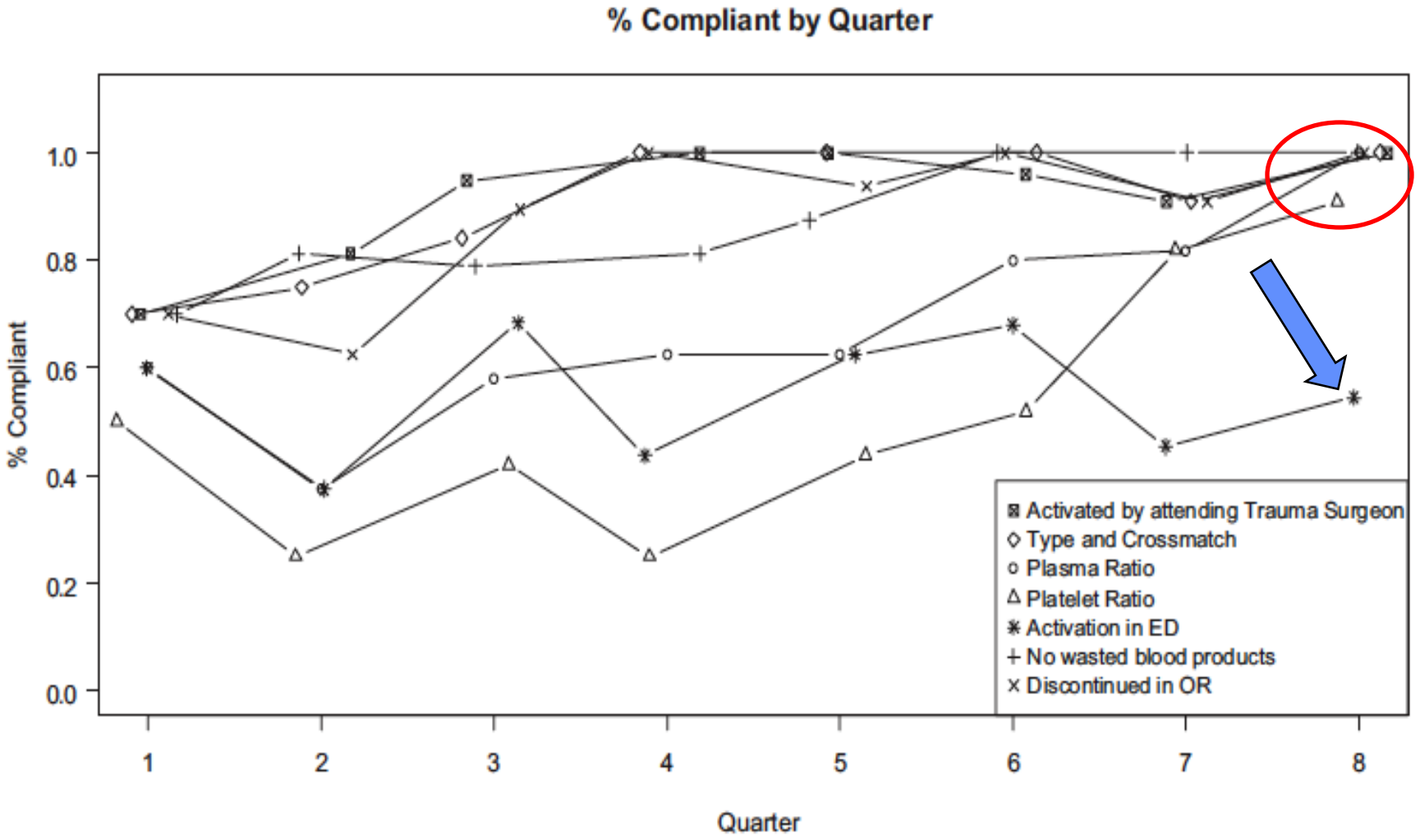
TABLE 4. Outcomes and Blood Utilization by Compliance

	Compliant (n = 34)	Noncompliant (n = 91)	*p*
24-h survival (%)	88.2 ± 5.5	61.5 ± 5.1	0.004
30-d survival (%)	86.7 ± 5.6	45.0 ± 5.2	<0.001
TEP cycles used	2.07 ± 1.0	2.28 ± 1.1	0.605
24-h RBC units	13.7 ± 1.3	19.5 ± 1.2	0.012
24-h plasma units	9.3 ± 0.7	10.7 ± 0.8	0.301
24-h platelets	4.1 ± 0.7	3.6 ± 0.7	0.372

Values are presented as mean ± SD.

TABLE 7. Unadjusted and Adjusted ORs for 30-d Survival by Individual PI Measure Compliance

Variable	Crude OR	95% CI	Adjusted OR	95% CI
ED protocol activation	3.44	1.927–6.157	2.79	1.039–7.497
Plasma:RBC ratio of 2:3	6.91	3.797–12.556	12.28	3.860–39.069
Platelet:RBC ratio of 1:5	7.78	3.814–15.871	3.72	1.392–9.975
Trauma attending activation	2.30	1.402–3.778	0.895	0.960–8.337
ED type and screen sent	2.15	1.315–3.539	0.195	0.023–1.621
Age (yr)	0.98	0.968–0.997	0.98	0.957–1.015
Male	1.12	0.841–1.500	0.75	0.264–2.157
ISS	0.98	0.963–0.0997	0.96	0.941–1.357


% Compliant by Quarter
% Compliant
1.0
0.8
0.6
0.4
0.2
0.0
1
2
3
4
5
6
7
8
Quarter
Activated by attending Trauma Surgeon
Type and Crossmatch
Plasma Ratio
Platelet Ratio
Activation in ED
No wasted blood products
Discontinued in OR

Conclusions

- Development and design must be multi-D
- Immediate availability of products
- Ratios of plasma and platelets matter
- Protocolization of the process matters
- Continuous PI/QI process is essential

The evolution of TQIP Best Practices for Massive Transfusion

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Massive Transfusion QI Projects

Bronson Methodist Hospital
Spectrum Health

TXA USE AT BRONSON

Bronson Methodist Hospital Trauma Services

Paul Blostein, MD
Rita Cox, BSN, RN

BRONSON

TXA at BMH

- Not using TXA for traumas prior to 10/12
- Reviewed with pharmacy and Blood Management Service
  - Orthopedics using TXA
  - Readily available
  - Affordable
- Trauma Service reviewing TXA use for appropriate cases

Trauma Services & TXA

- October 10, 2012
- Trauma Grand Rounds Guest Lecturer
  Dr. Erwin Gross

  - Medical director of Transfusion Services and Patient Blood Management for Eastern Maine Medical Center
  - Management of Massive Hemorrhage in Trauma
  - Champions use of TXA and TEG in trauma

4 Hours After Presentation

- 10/10/12 1pm – Tier 1 Trauma Activation
- 23 y/o male, train vs. bicycle
  - GCS 6 at scene
  - P 147 BP 93/56 R 30
  - Large posterior scalp avulsion and complex left ear laceration
  - Complete amputation L foot and L forearm
  - R hip dislocation
  - Intubated
  - To BMH by West Michigan AirCare
  - 1 U PRBCs in flight, 1 U in ER, 1 U FFP

At BMH

- P 118 BP 77/59
- MTP initiated
- TXA administered, bolus and infusion
- Bleeding controlled, CT vertex to anus
- 3 U PRBCs + 1 FFP
- To OR in 90”: wound debridements, wound repairs, scalp Wound VAC, bilat chest tubes
- ISS 29
- D/C to rehab at MFB PID #49
- TXA feasible in our ER/Trauma protocols

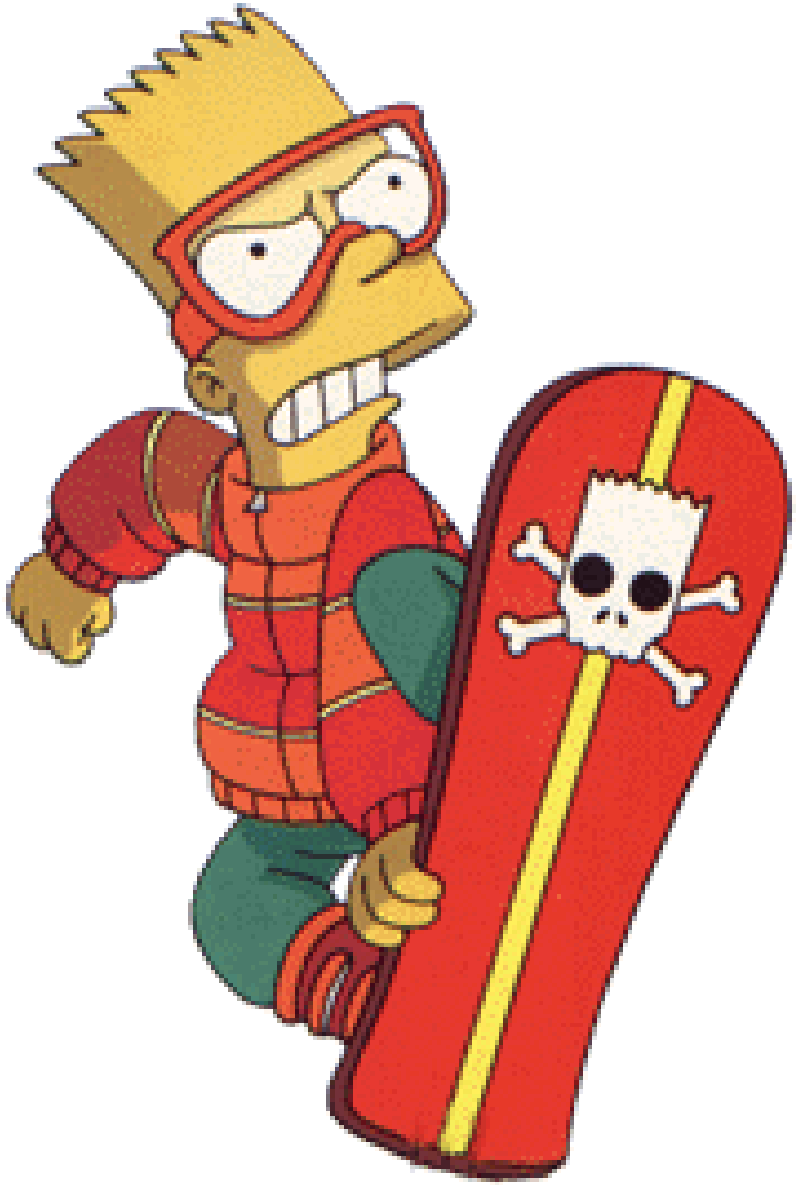
- Added TXA to trauma registry 11/1/12
- 2013 MTQIP PI Project
  - Increase use of TXA in appropriate MTP patient population

MTP at BMH

- Shock with Class 3 or 4 hemorrhage
- Uncontrolled peri- or intraoperative bleeding
- Severely hemorrhaging injuries
- Profound GI bleeding
- Ruptured AAA
- Trauma surgeon karma

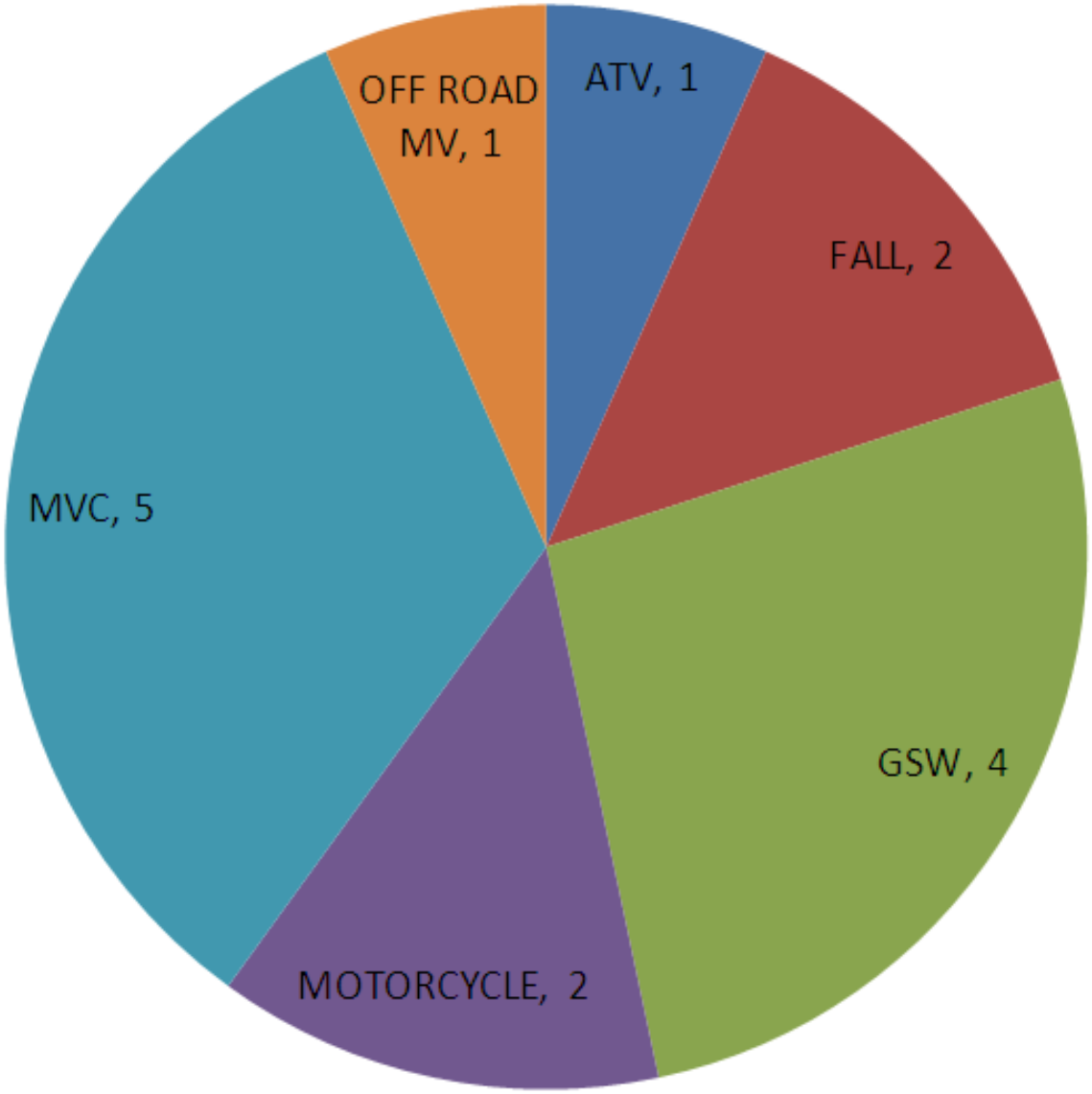
TXA Use

	Oct 12 –Jan 13	Feb 13-May 13	Jun 13-Sept 13
Percent	50% (4 of 8)	100% (5 of 5)	100%(9 of 9)
Action Plan	• Education: Trauma Grand Rounds March 2013	• Education: Trauma Grand Rounds June 2013 • Education: SICU Inservice on TEG/TXA June 2013	• Education: Trauma Grand Rounds Nov 2013



TXA in BMH Trauma
December 2012 - Present

- 15 patients
- Age range 13 – 63 years, mean 34
- ISS range 4 – 57, mean 27
- Mortality 3/15, 20%
- Mean transfusion first 4 hours: 1.3 U
- Mean transfusion first 24 hours: 2.8 U
- 2011 mean transfusion first 24 hours: 4.3 U (n = 73)



Mechanism Of Injury

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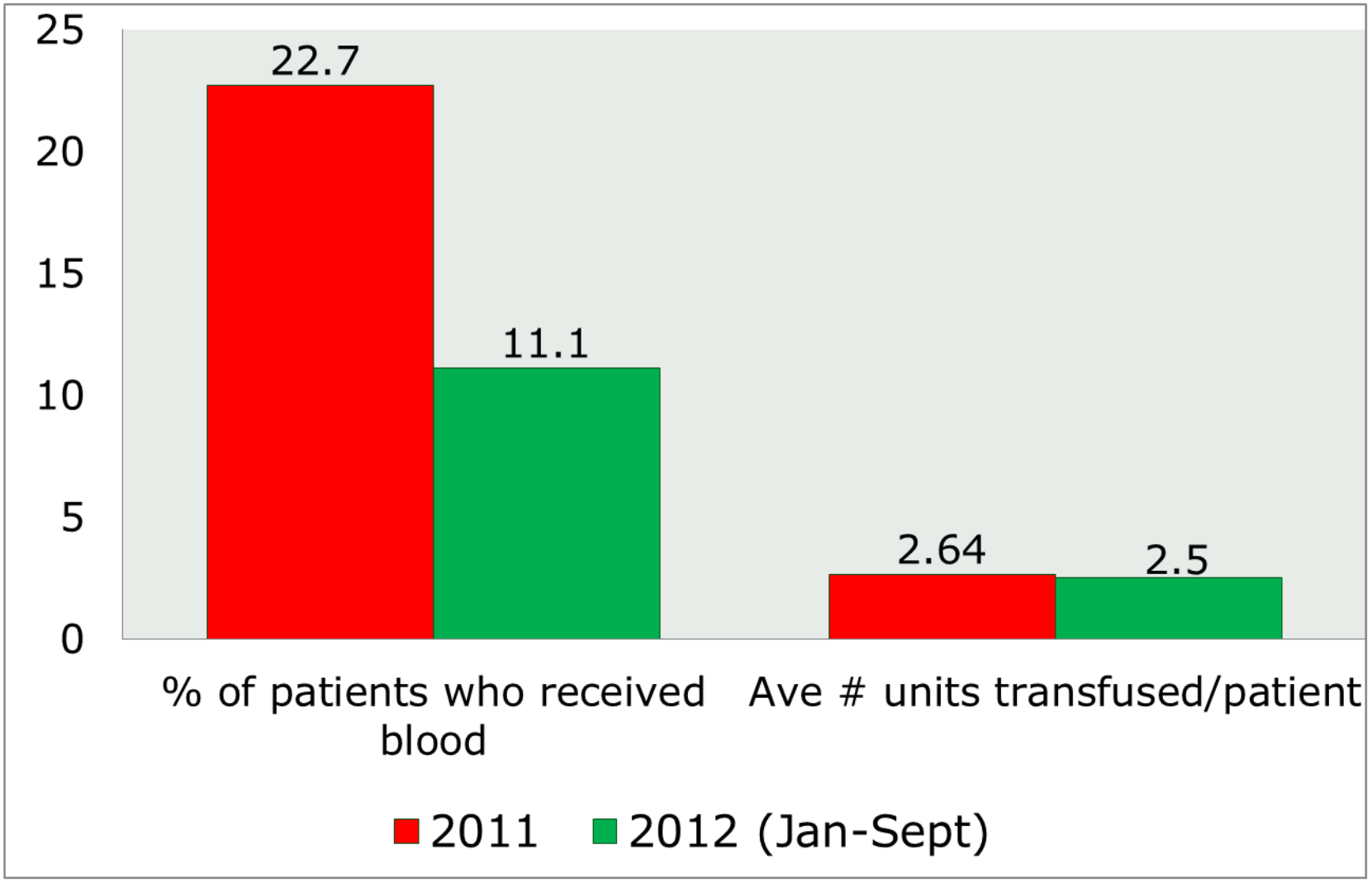
Bronson: Orthopedic Hip/Knee/Spine Patients and Blood Transfusions



Effects OF TXA On Total Knee Arthroplasty Blood Utilization

- Objective
  - To evaluate the effect of tranexamic acid on allogeneic blood transfusions in patients undergoing TKA at Bronson Methodist Hospital
- Retrospective cohort study

Patient Selection

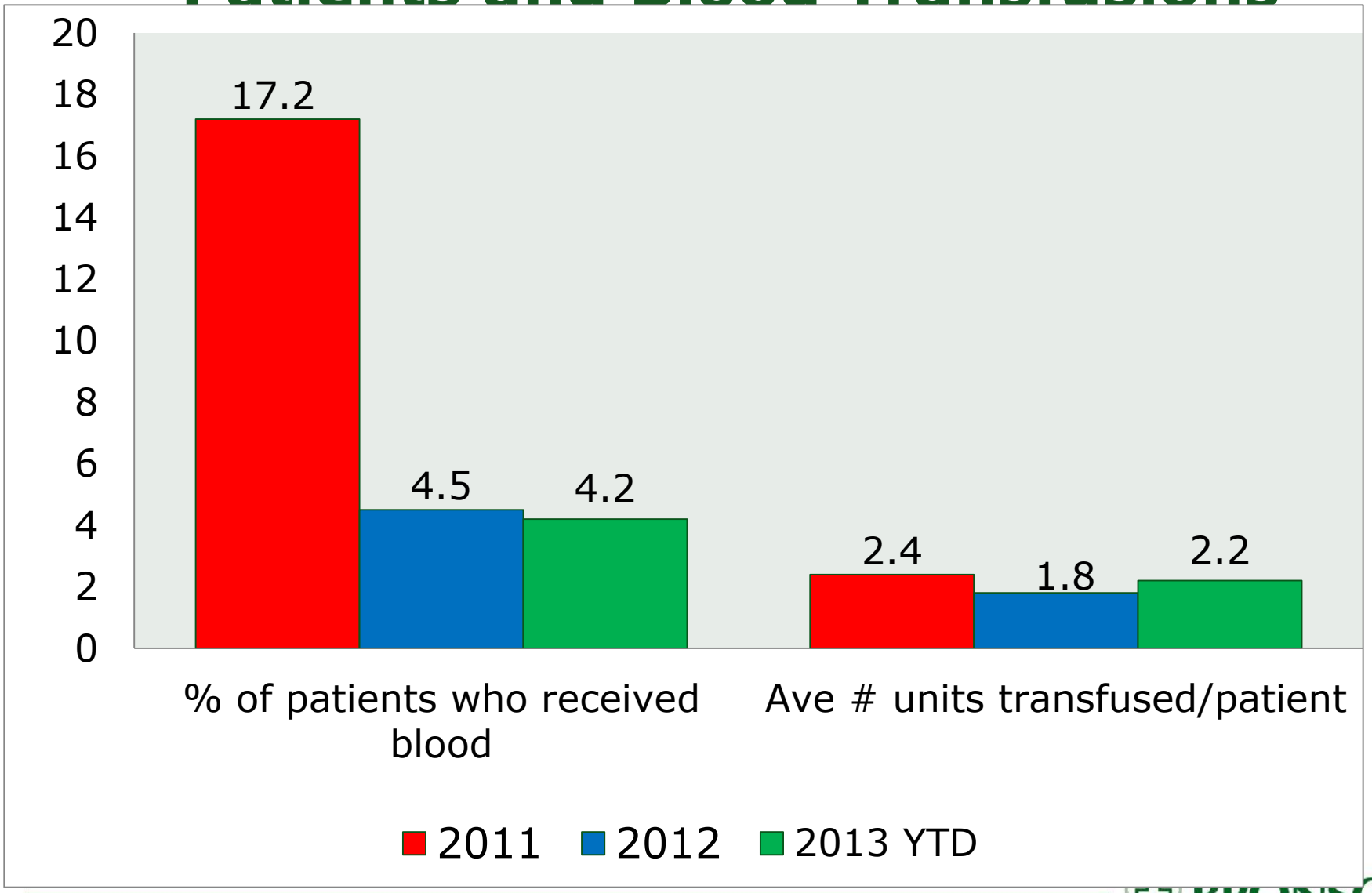
Inclusion Criteria

- Age > 18 years old
- Primary unilateral TKA
  - January 2009 to December 2012
- Treatment group
  - Received TXA during the perioperative period
- Control group
  - Did not receive TXA during the perioperative period

Exclusion Criteria

- Age < 18 years old
- Concurrent surgery with unilateral TKA
- Revision of a previous TKA
- Bilateral TKA

Bronson: Total Knee Arthroplasty Patients and Blood Transfusions



Baseline Characteristics

	Control (n=61)	Treatment (n=60)	p-value
Age (years)*	66.1 (SD±9.6)	66.9 (SD±9.9)	0.63
Gender, n Men Women	 25 (41%) 36 (59%)	 16 (27%) 44 (73%)	0.12
Weight (kg)*	93 (SD ±17.2)	91.2 (SD±17.9)	0.57
Height (cm)*	168.1 (SD±10.9)	166 (SD±8.2)	0.23
Indication, n	OA = 56[+] RA = 2 Other = 3	OA = 56 RA = 4 Other = 0	0.105
TXA dose, n 10 mg/kg 15 mg/kg	 n/a	 17 43	 n/a
Comorbidities*	2.3 (SD±1.3)	2.5 (SD±1.6)	0.42

*Mean and standard deviation (SD); OA = osteoarthritis; RA = rheumatoid arthritis
[+]1 patient had OA & RA

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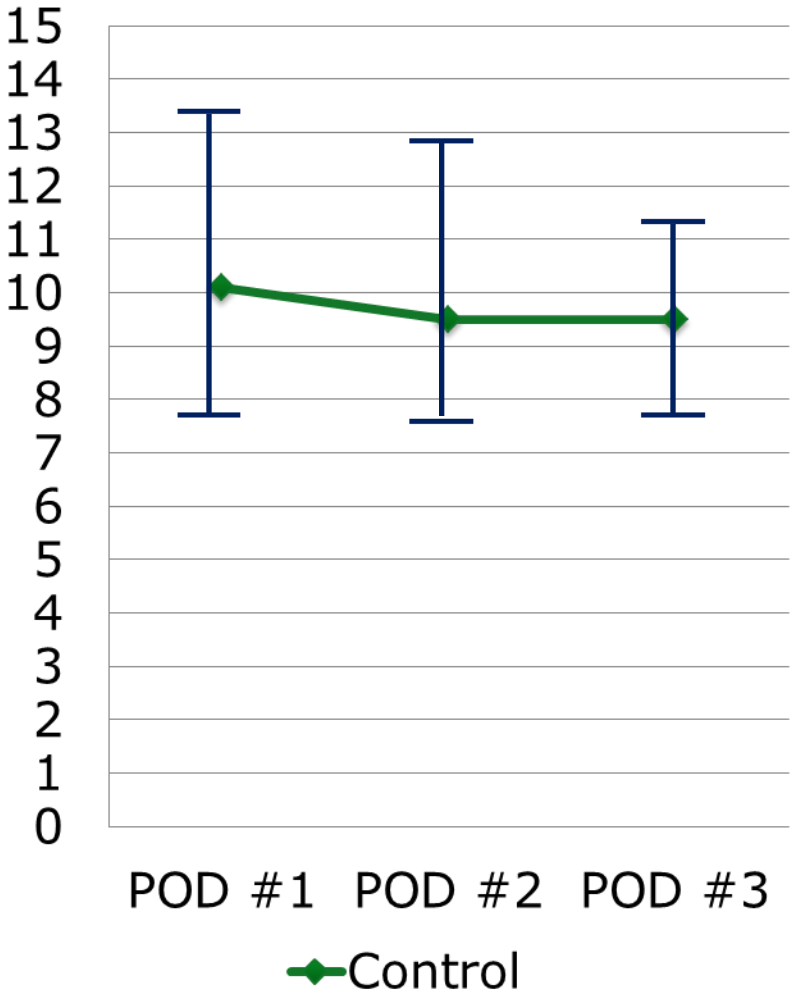
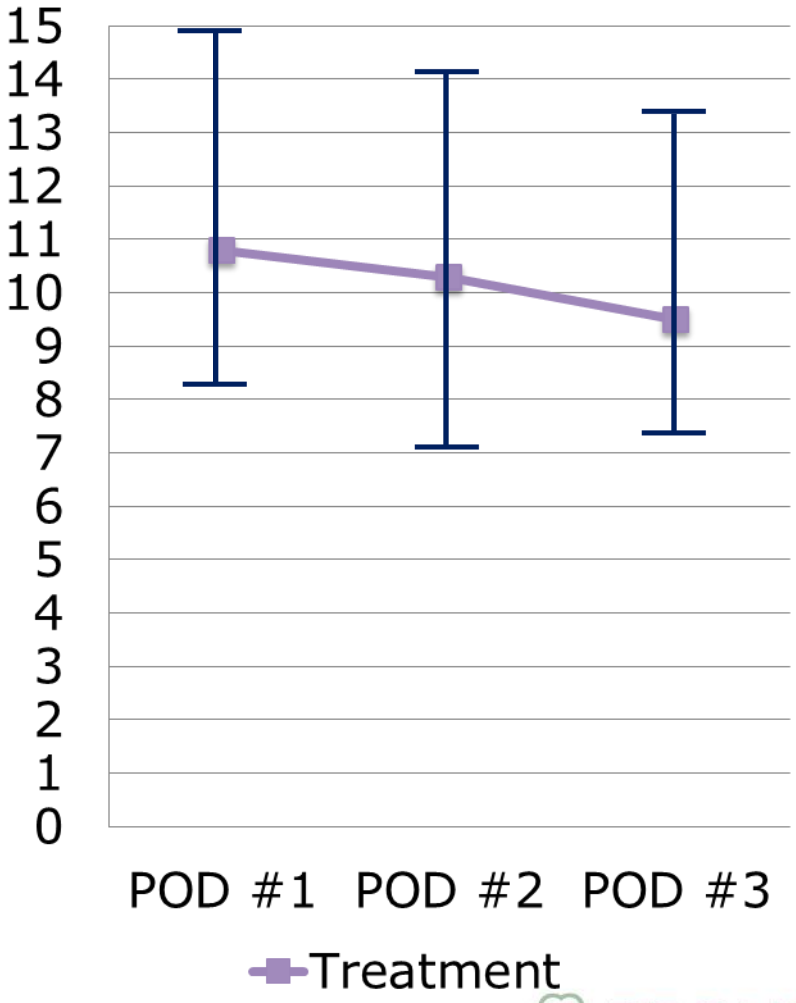
Results

	Control (n=61)	Treatment (n=60)
Total EBL (mL)+	300 (0 – 1000)	300 (20-500)
Length of Case (minutes)+	168 (115-366)	187.5 (124-298)
Anesthesia , n General Spinal	 55 6	 44 16
Knee Block , n	61	59
Cement, n	61	60
LOS (days)*	4 (SD±0.8)	3.72 (SD±0.66)
Total drain loss (mL) +	710 (40-1620)	392.5 (55-820)
Net intraoperative fluids (mL)+	1850 (800-4000)	1900 (500-3200)

*Mean and standard deviation (SD); +median and range; EBL = estimated blood loss;
LOS = length of stay
Blood loss: Minimal = 50mL and < 100 = 100mL

Postoperative Hemoglobin





POD = postoperative day

Next Steps

- Working with Blood Management Service to look at TXA/blood utilization for spine cases
- WMAC: TXA now carried on aircraft
- Continue to look at patient outcomes and blood utilization in trauma patients
- April 2014: Dr. Todd Rasmussen presenting at WMU Grand Rounds

- TXA added to WMAC protocols ~Sept 2013
  - Utilized at least once since initiation
- TXA potential for regional use
- TXA for CVA

Thank You!

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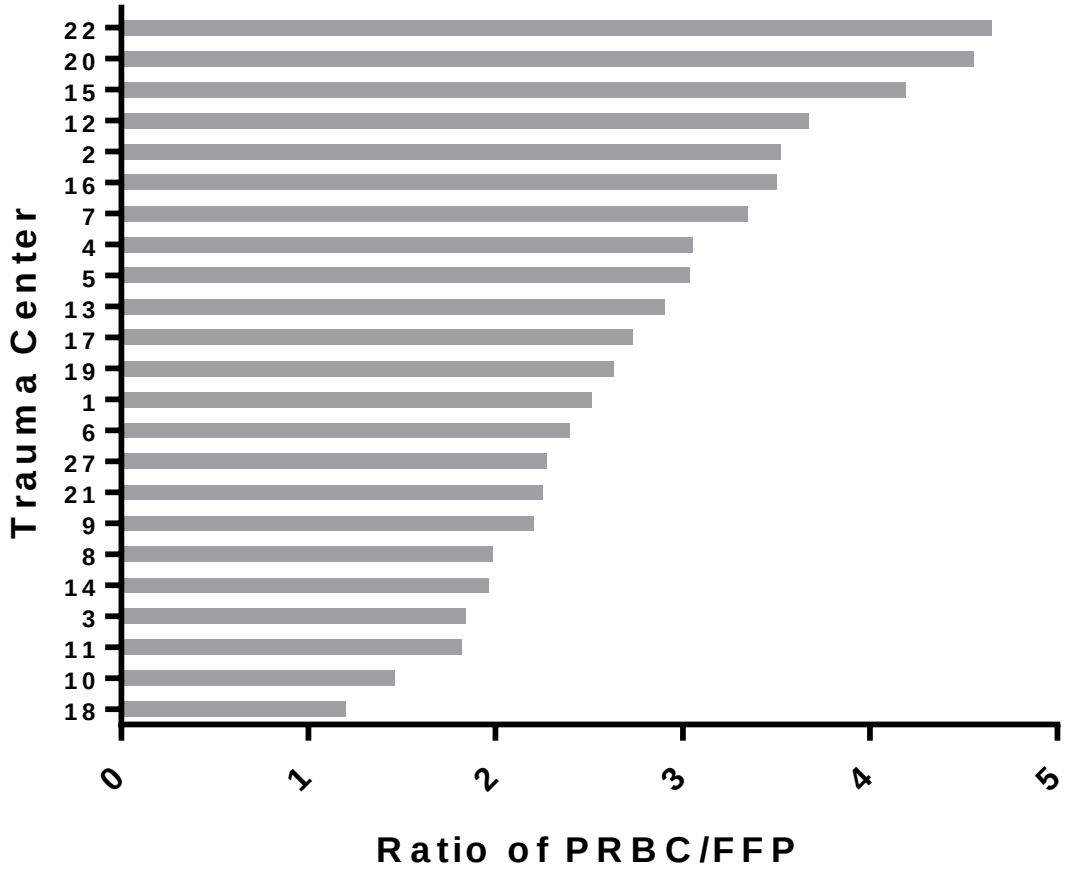
MTQIP Blood Usage

- Collect on all patients receiving any PRBC's in first 24hrs.
- PRBC's, FFP, Plt's, Cryo totals in first 4 hrs
- PRBC's, FFP, Plt's, Cryo totals first 24 hrs
- TXA use, date, time
- OR for Hemorrhage control
- Angio for Hemorrhage control

Blood Product Usage in first 24 hrs if ≥ 5 uPRBCs



recordno	age	ed_arrdate	mech	ed_bp	iss	prbc4	ffp4	plt4	cryo4	ratio4	prbc24	ffp24	plt24	cryo24	ratio24	txa	dead
47934	35	4-Jul-11	Penetrating	52	41	0	0	0	0		14	6	3	0	2.3		1
48029	52	16-Jul-11	Blunt	65	43	0	0	0	0		6	6	2	0	1		0
48050	48	19-Jul-11	Blunt	112	30	0	0	0	0		5	2	5	0	2.5		0
48054	50	19-Jul-11	Blunt	60	66	0	0	0	0		9	8	2	0	1.1		1
48214	19	15-Aug-11	Blunt	75	66	0	0	0	0		37	16	21	0	2.3		1
48387	52	11-Sep-11	Blunt	108	34	0	0	0	0		6	4	0	0	1.5		0
48628	75	1-Nov-11	Blunt	113	26	0	0	0	0		14	8	6	0	1.8		1
48679	19	9-Nov-11	Blunt	99	45	0	0	0	0		7	0	0	0			0
48701	26	12-Nov-11	Penetrating	150	19	0	0	0	0		8	2	2	0	4		0
48847	42	19-Dec-11	Blunt	87	45	0	0	0	0		37	14	10	0	2.6		0
49085	67	8-Feb-12	Blunt	159	50	0	0	0	0		23	17	7	0	1.4		1
49131	63	17-Feb-12	Blunt	143	34	0	0	0	0		5	0	0	0			0
49263	57	20-Mar-12	Blunt	117	33	0	0	0	0		12	6	1	0	2		1
49264	27	20-Mar-12	Blunt	131	36	0	0	0	0		13	6	1	0	2.2		1
49319	39	2-Apr-12	Blunt	127	59	0	0	0	0		11	0	0	0			0
49335	28	4-Apr-12	Blunt	93	24	0	0	0	0		6	4	1	0	1.5		0
49402	20	21-Apr-12	Blunt		75	0	0	0	0		14	8	4	0	1.8		1
49462	24	3-May-12	Blunt	110	57	0	0	0	0		16	7	5	0	2.3		0
49530	26	17-May-12	Penetrating	86	20	7	6	1	0	1.2	7	6	1	0	1.2		0
49531	49	18-May-12	Blunt	128	42	0	0	0	0		14	8	2	0	1.8		1
49532	50	19-May-12	Blunt	89	19	0	0	0	0		5	2	0	0	2.5		1
49820	40	5-Jul-12	Penetrating	141	17	8	14	5	0	0.6	8	14	5	0	0.6		0
49841	29	6-Jul-12	Blunt	138	66	0	0	0	0		13	8	2	0	1.6		0
49878	20	14-Jul-12	Penetrating	90	26	0	0	0	0		14	10	3	0	1.4		0
49932	33	22-Jul-12	Blunt	99	38	6	2	1	0	3	12	7	3	0	1.7		0
49977	75	29-Jul-12	Blunt	76	29	0	0	0	0		5	0	0	0			0
50046	48	12-Aug-12	Penetrating	136	27	18	0	0	0		18	0	0	0			1
50160	25	3-Sep-12	Penetrating	90	18	0	0	0	0		22	4	5	0	5.5		0
50187	62	9-Sep-12	Blunt	104	50	0	0	0	0		9	6	2	0	1.5		0
50431	65	25-Oct-12	Blunt	159	29	0	0	0	0		7	5	1	0	1.4		0

MTQIP Report Tool

Mark Hemmila, MD

Emergent Cholecystectomy Data

Mark Hemmila, MD

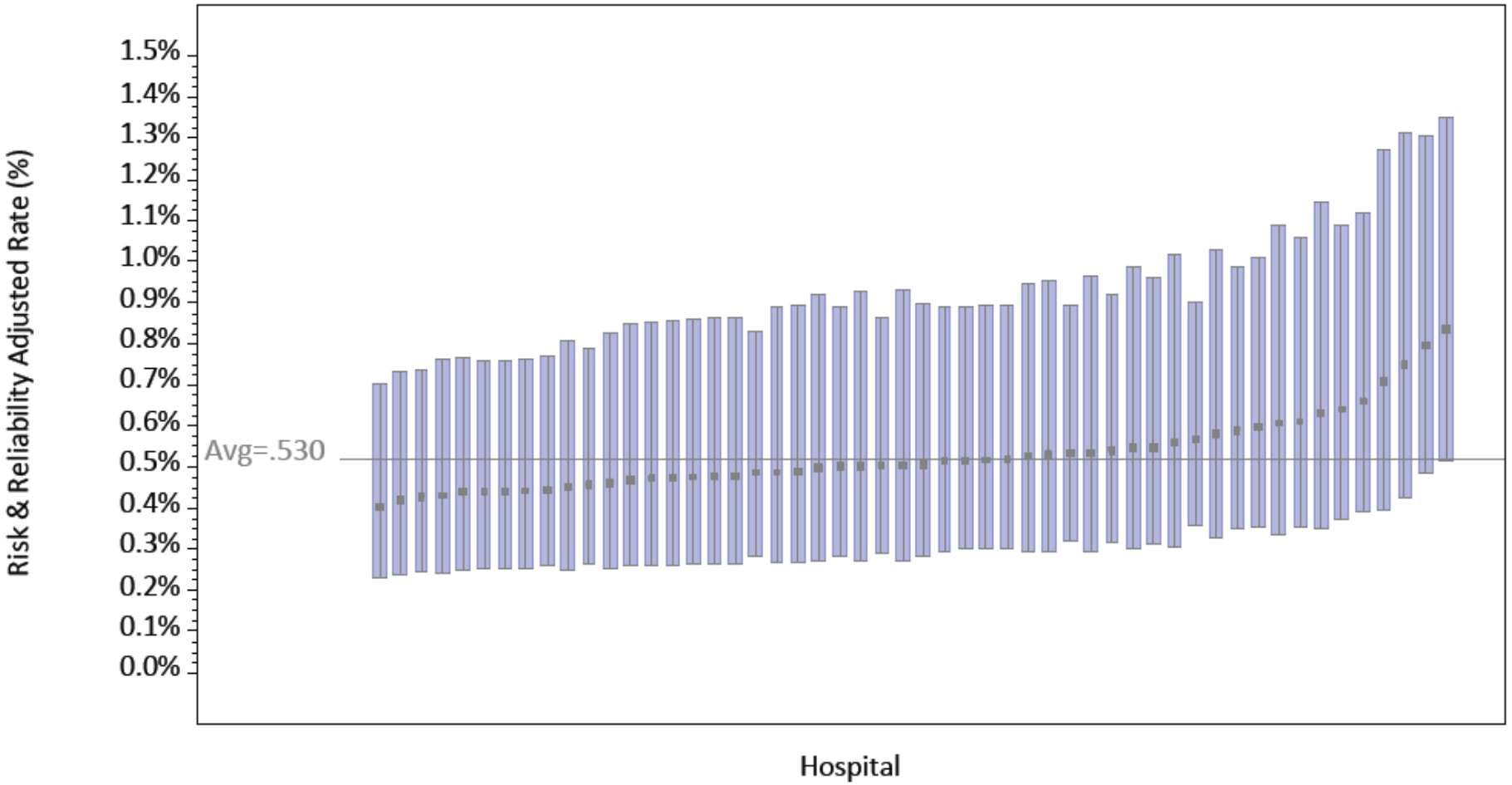
Inclusion Criteria
Cholecystectomy for Cholecystitis

- **1. ICD-9 (at least one)**
  - 574.00, 574.01, 574.30, 574.31, 574.60, 574,61, 574.80, 574.81, 575.0, 575.12 (acute cholecystitis)
  - 575.11 (chronic cholecystitis)
  - 574.10, 574.11, 574.40, 574.41, 574.70, 574.71, 575.1, 575.10 (other cholecystitis)
- **2. CPT (at least one)**
  - 47562 (laparoscopy, surgical, cholecystectomy)
  - 47563 (laparoscopy, surgical, cholecystectomy with cholangiography)
  - 47564 (laparoscopy, surgical, cholecystectomy with exploration of common duct)
  - 47600 (cholecystectomy)
  - 47605 (cholecystectomy, with cholangiography)
  - 47610 (cholecystectomy, with exploration of common duct)
- **January 1, 2008 and June 5, 2013**

Variable		Aggregate N = 18,161 N	%
Age	15-18	128	0.7
	19-49	8864	48.8
	50-74	7210	39.7
	≥75	1959	10.8
Mean Age, y		50.3 +/- 17.9	
Gender	Female	12730	70.1
	Male	5431	29.9
Race	White	13799	76.0
	Other	4362	24.0
ASA Class	1 - No Disturb	1583	8.7
	2 - Mild Disturb	10693	58.9
	3 - Severe Disturb	5362	29.5
	4 - Life Threat	500	2.8
	5 - Moribund	3	0.0
Surgical Priority	Emergent	1603	8.8
Surgical Technique	Laparoscopic	16603	91.4
	Open	1558	8.6

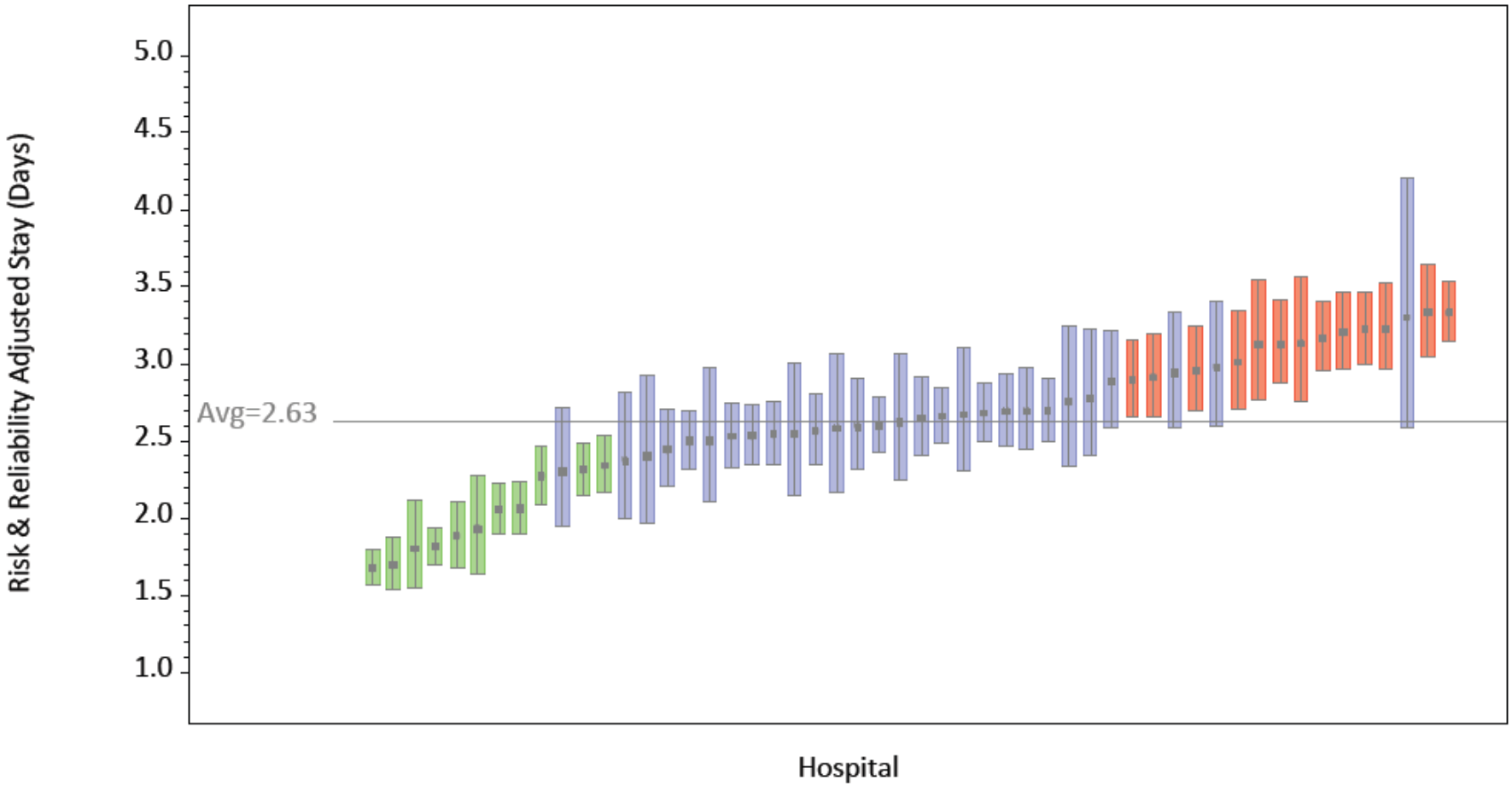
Mortality

Risk and Reliability Adjusted Rate (%) with 90% confidence Intervals by Hospital for Cholecystectomy, MSQC Group 1/1/2008 - 6/05/2013 (n=18,161)



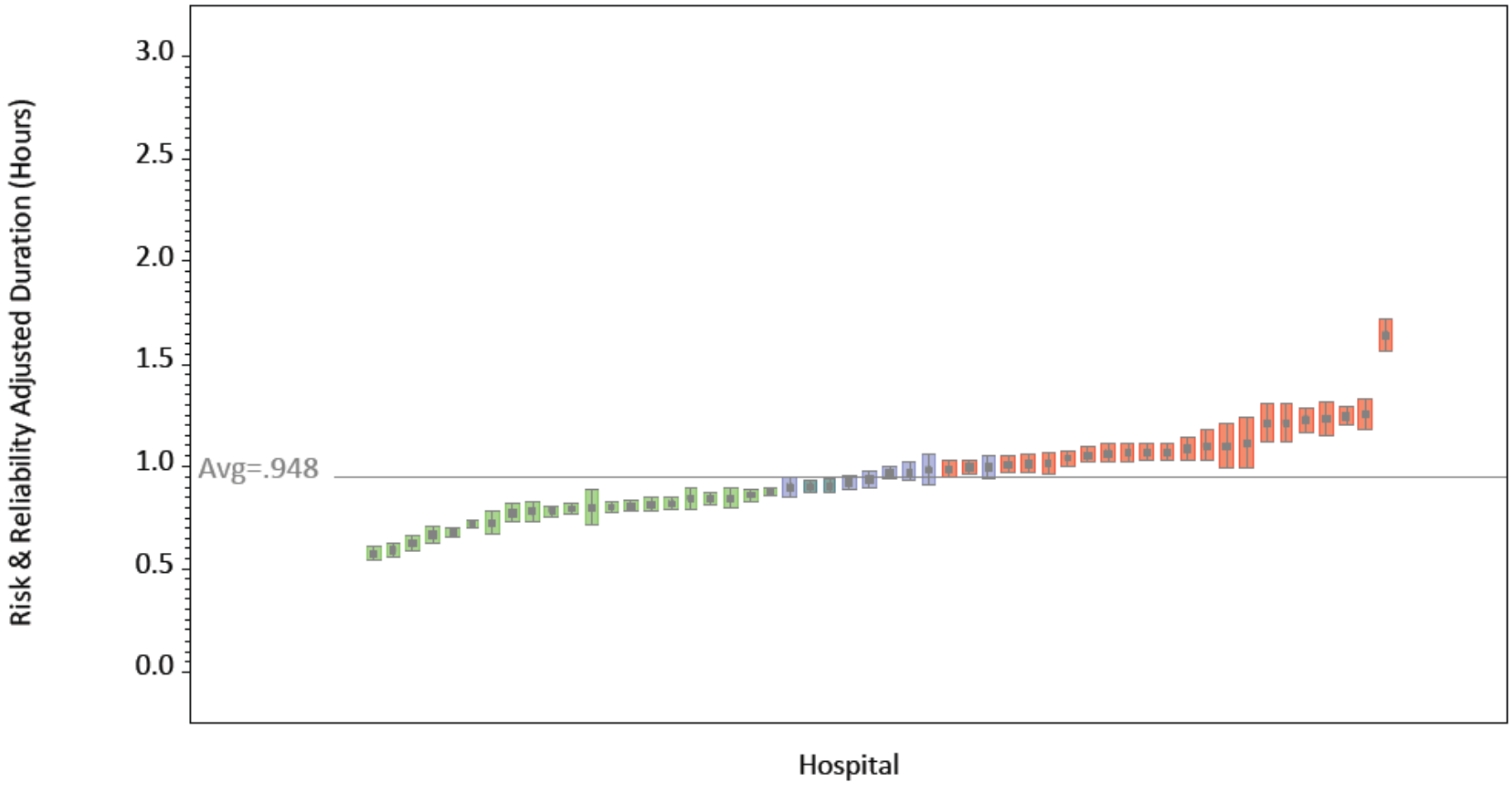
LOS

Risk and Reliability Adjusted Stay (Days) with 95% confidence Intervals by Hospital for Cholecystectomy, MSQC Group 1/1/2008 - 6/05/2013 (n=18,161)



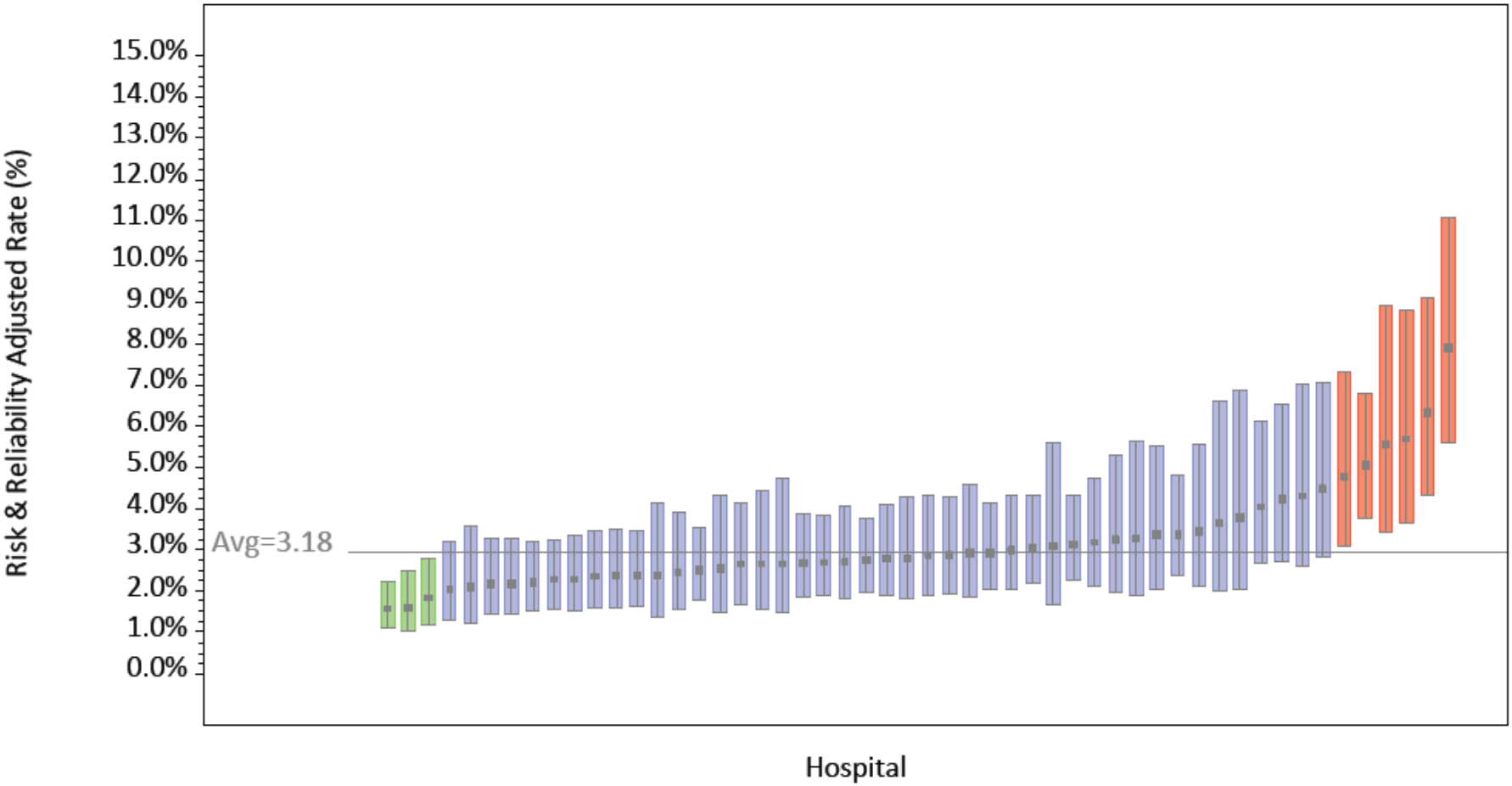
OR Time

Risk and Reliability Adjusted Duration (Hours) with 95% confidence Intervals by Hospital for Cholecystectomy, MSQC Group 1/1/2008 - 6/05/2013 (n=18,161)



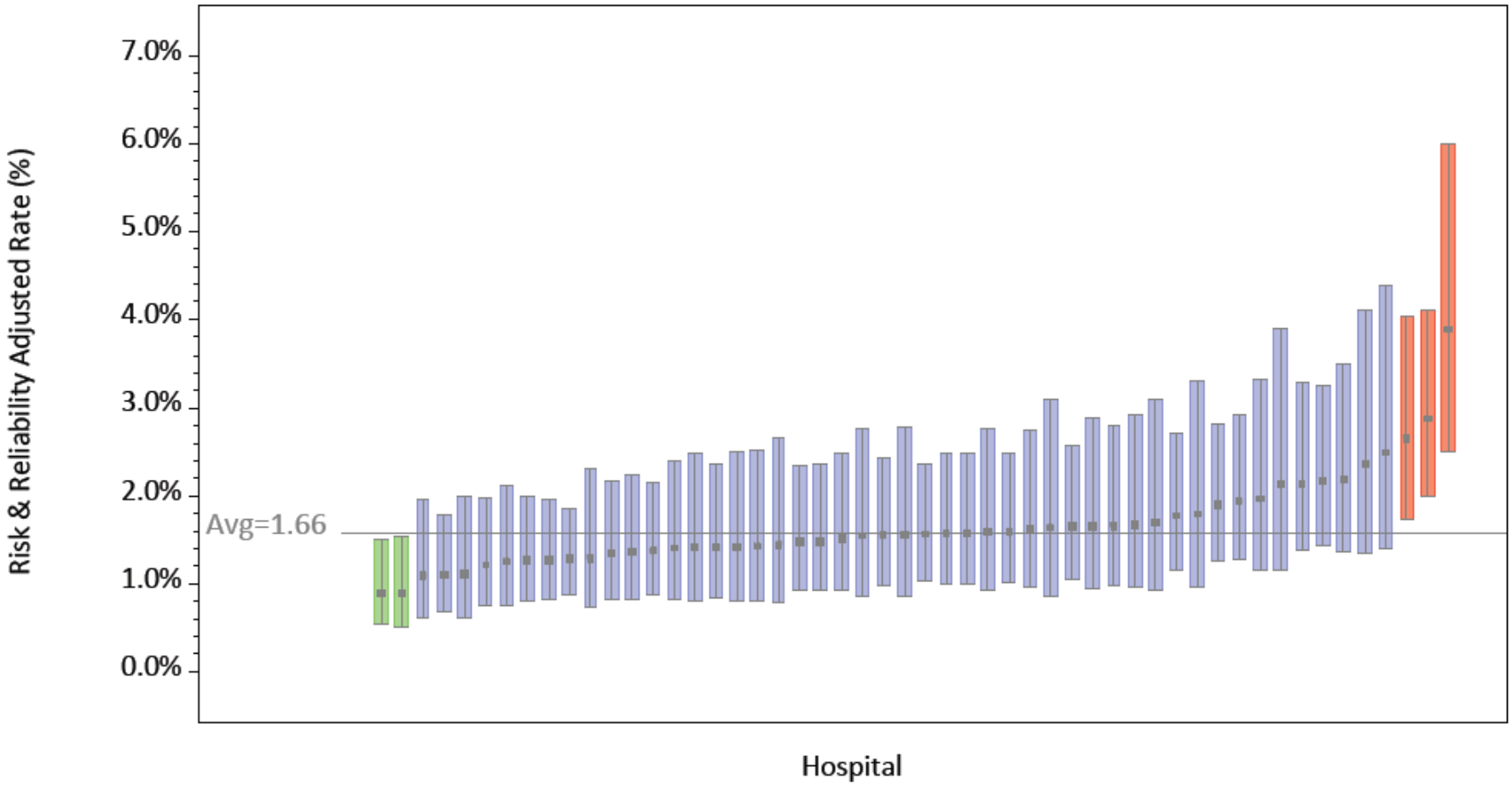
Readmission

Risk and Reliability Adjusted Rate (%) with 90% confidence Intervals by Hospital for Cholecystectomy, MSQC Group 1/1/2008 - 6/05/2013 (n=18,161)



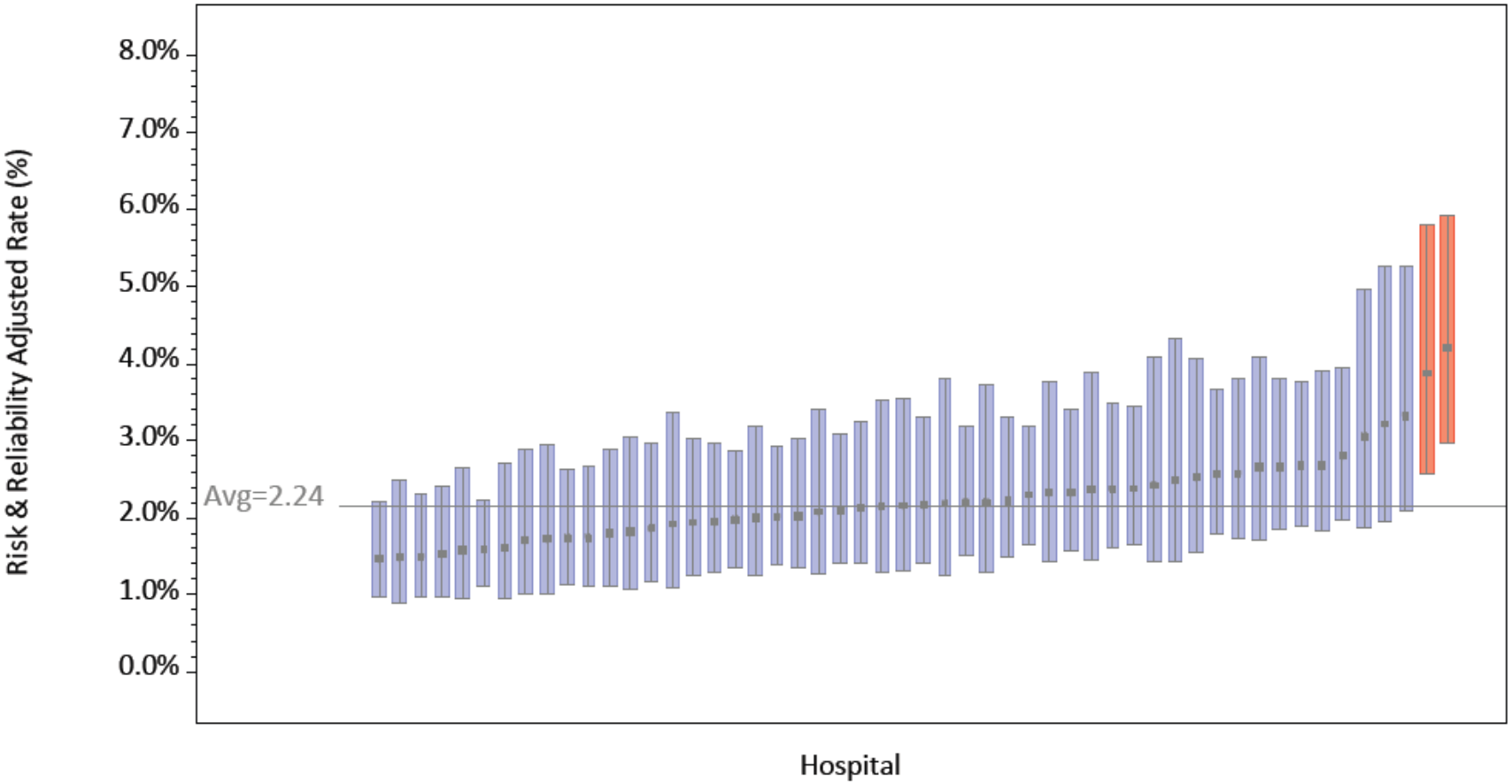
Return to OR

Risk and Reliability Adjusted Rate (%) with 90% confidence Intervals by Hospital for Cholecystectomy, MSQC Group 1/1/2008 - 6/05/2013 (n=18,161)



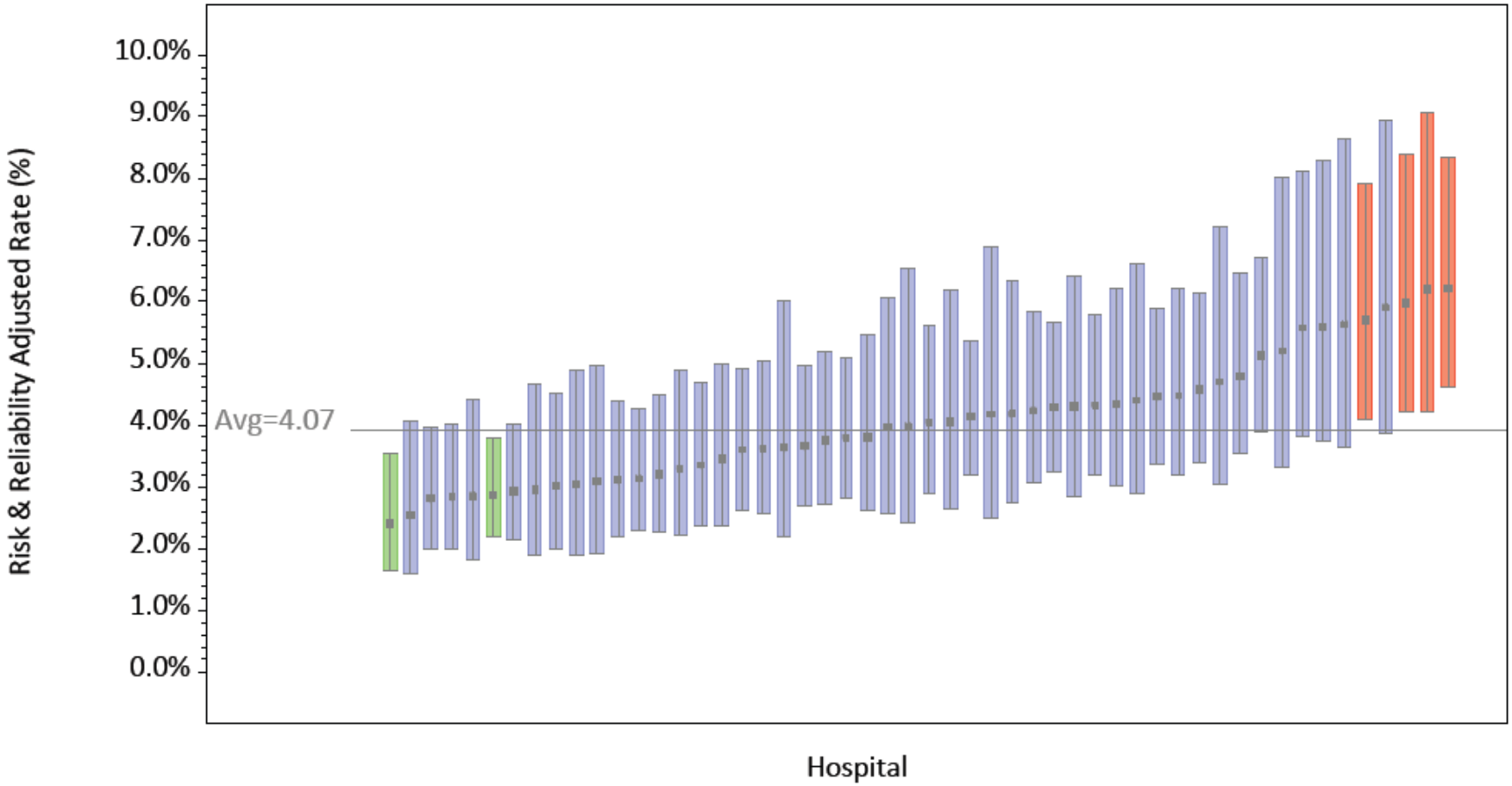
Major Complication

Risk and Reliability Adjusted Rate (%) with 90% confidence Intervals by Hospital for Cholecystectomy, MSQC Group 1/1/2008 - 6/05/2013 (n=18,161)



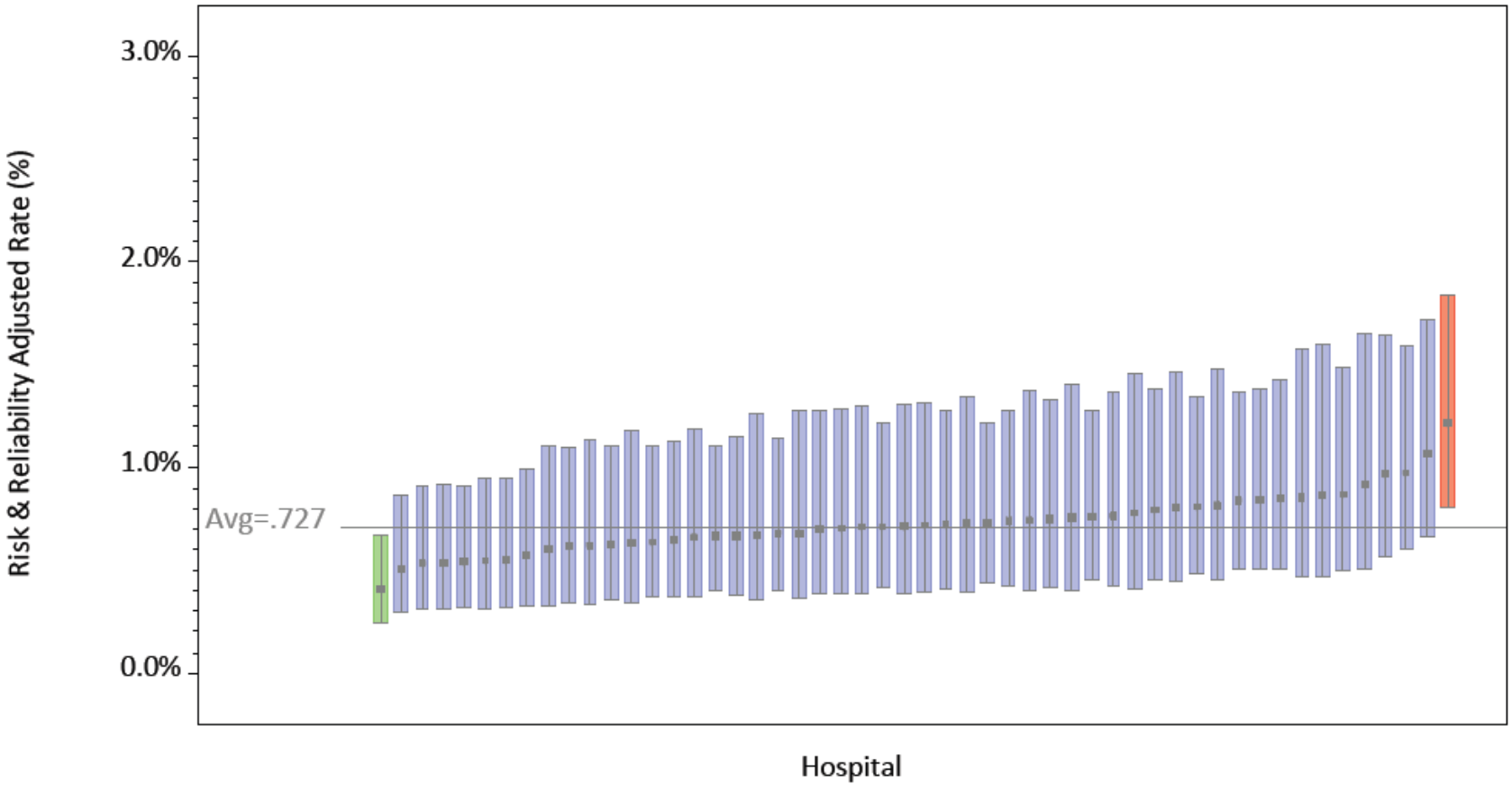
Any Complication

Risk and Reliability Adjusted Rate (%) with 90% confidence Intervals by Hospital for Cholecystectomy, MSQC Group 1/1/2008 - 6/05/2013 (n=18,161)



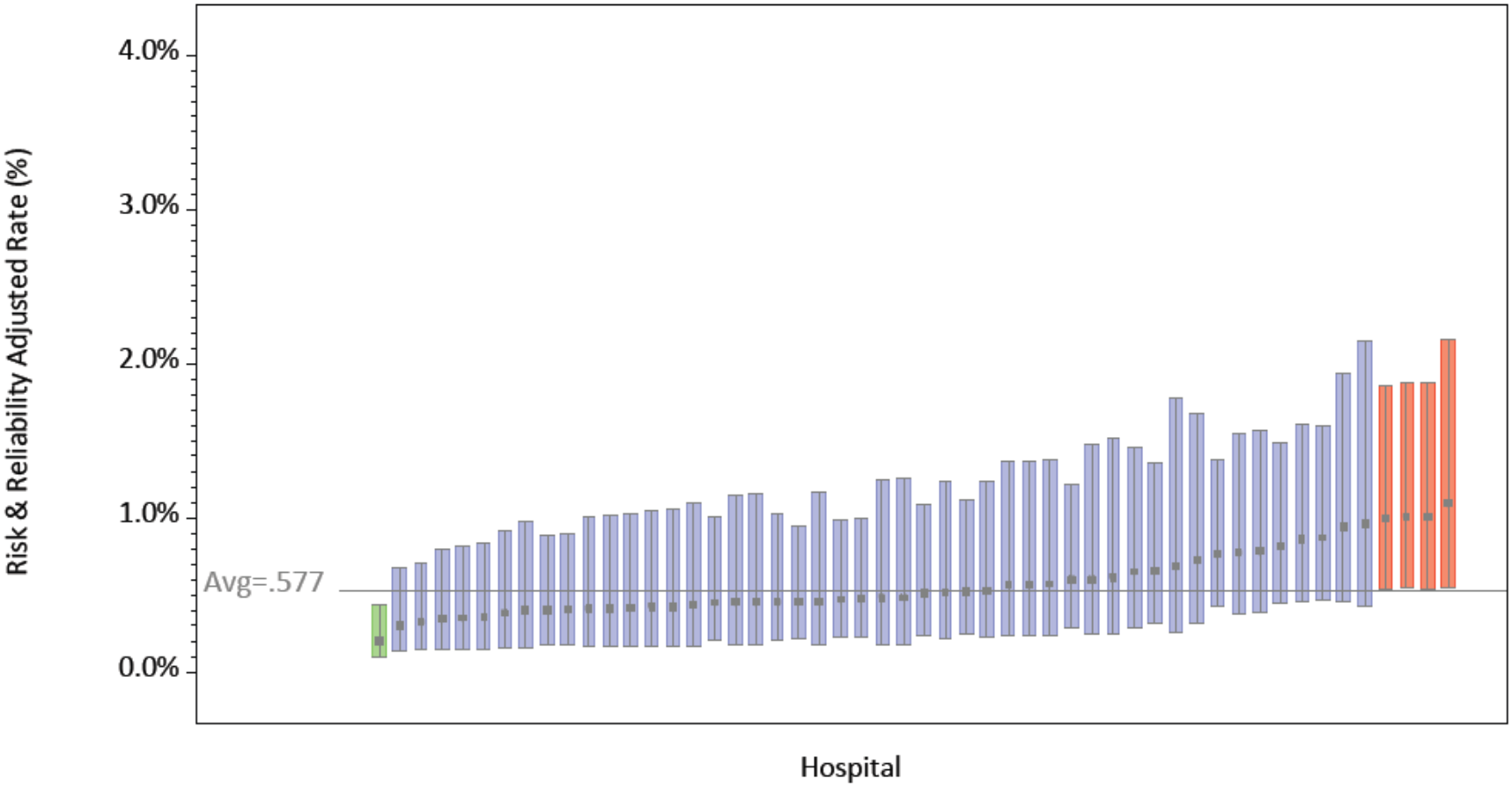
Superficial or Deep SSI

Risk and Reliability Adjusted Rate (%) with 90% confidence Intervals by Hospital for Cholecystectomy, MSQC Group 1/1/2008 - 6/05/2013 (n=18,161)



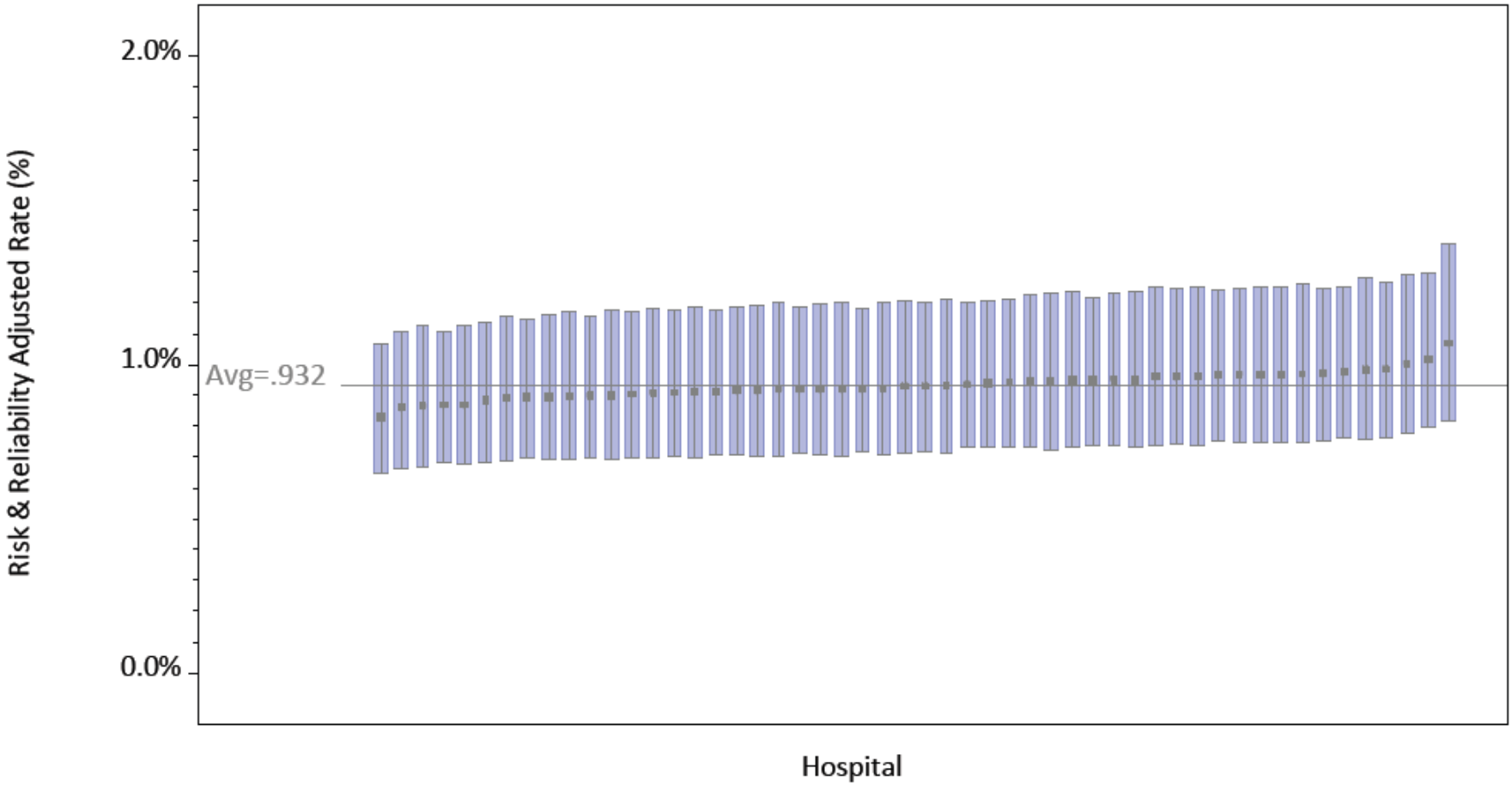
Organ Space SSI

Risk and Reliability Adjusted Rate (%) with 90% confidence Intervals by Hospital for Cholecystectomy, MSQC Group 1/1/2008 - 6/05/2013 (n=18,161)



Sepsis or Severe Sepsis

Risk and Reliability Adjusted Rate (%) with 90% confidence Intervals by Hospital for Cholecystectomy, MSQC Group 1/1/2008 - 6/05/2013 (n=18,161)



Data Gaps

- Appendectomy
  - ED Date/Time
  - Studies (USN, CT, MRI)
  - Pathology result
  - Grading (AAST)

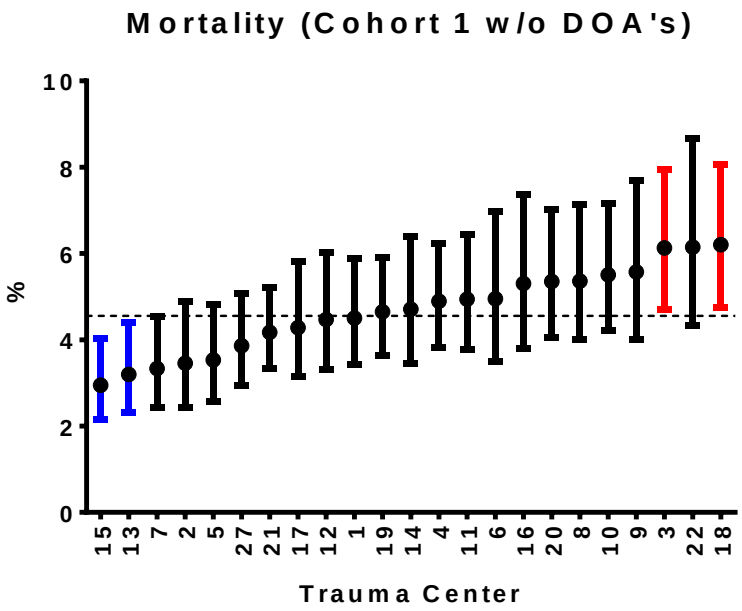
Data Gaps

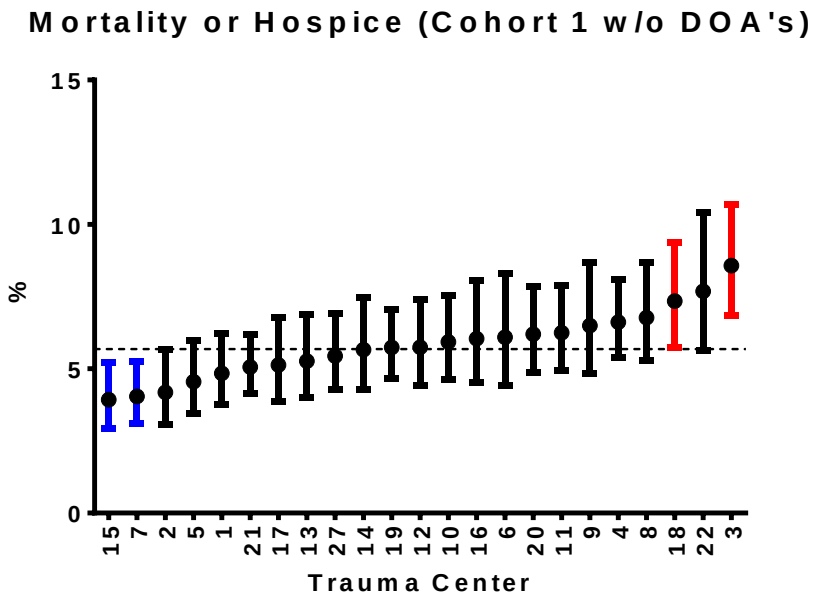
- Cholecystectomy
  - ED Date/Time
  - Studies (USN, CT, HIDA)
  - Consults
  - ERCP
  - Conversion rate
  - Postop complications (specific)
    - Fluid collection/drain, cystic duct stump leak
    - Retained CBD stone
    - CBD injury
  - Grading (AAST)

MTQIP Data

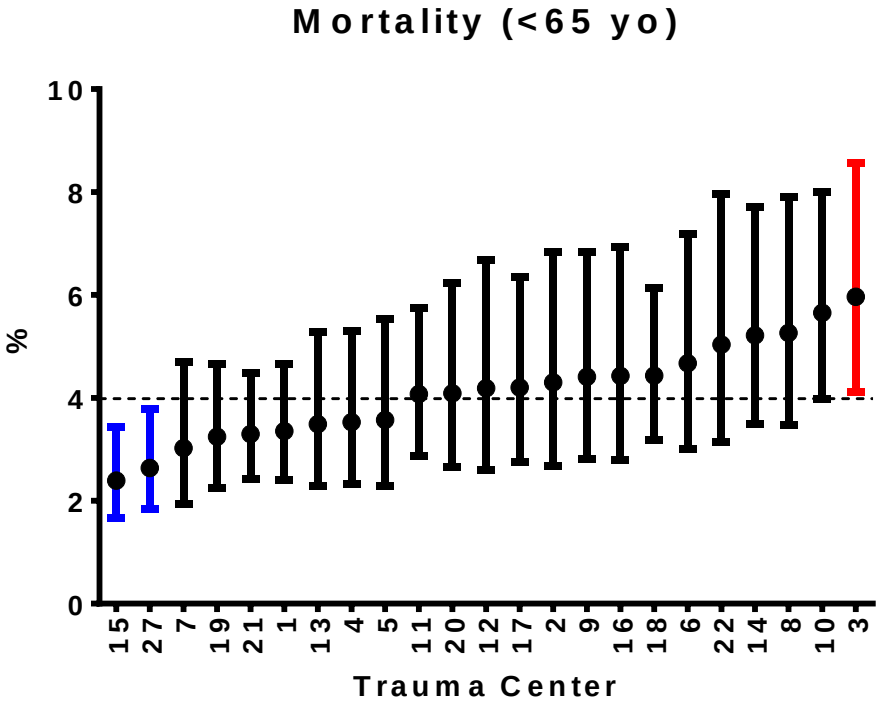
Mark Hemmila, MD

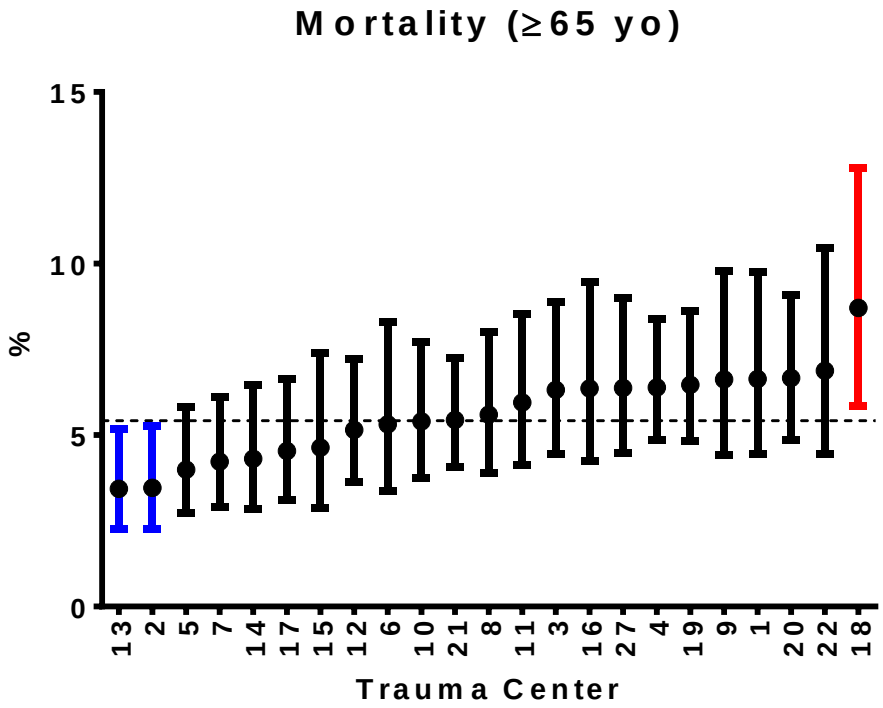
11/1/2011 to 10/31/2012



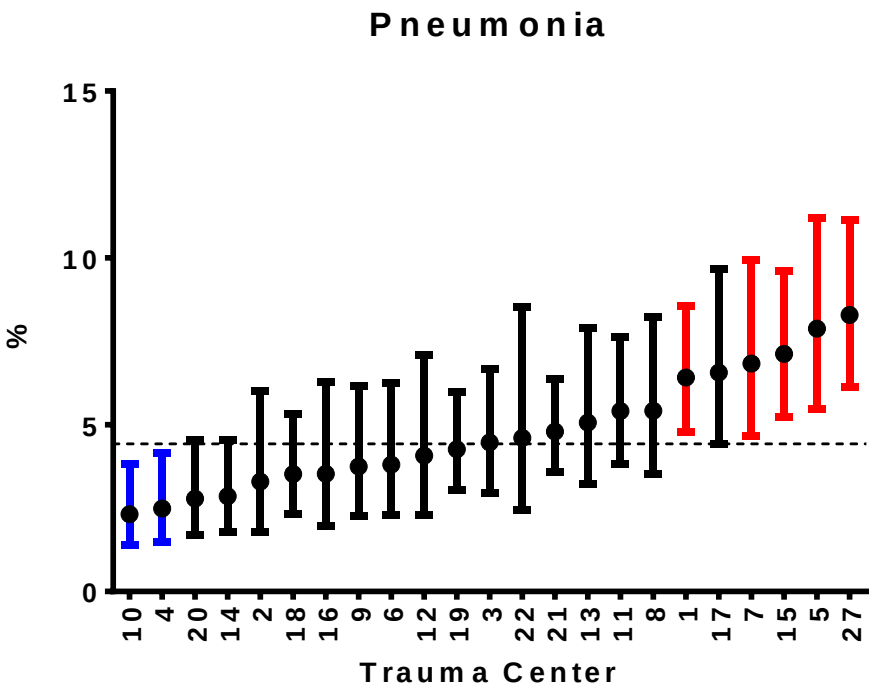


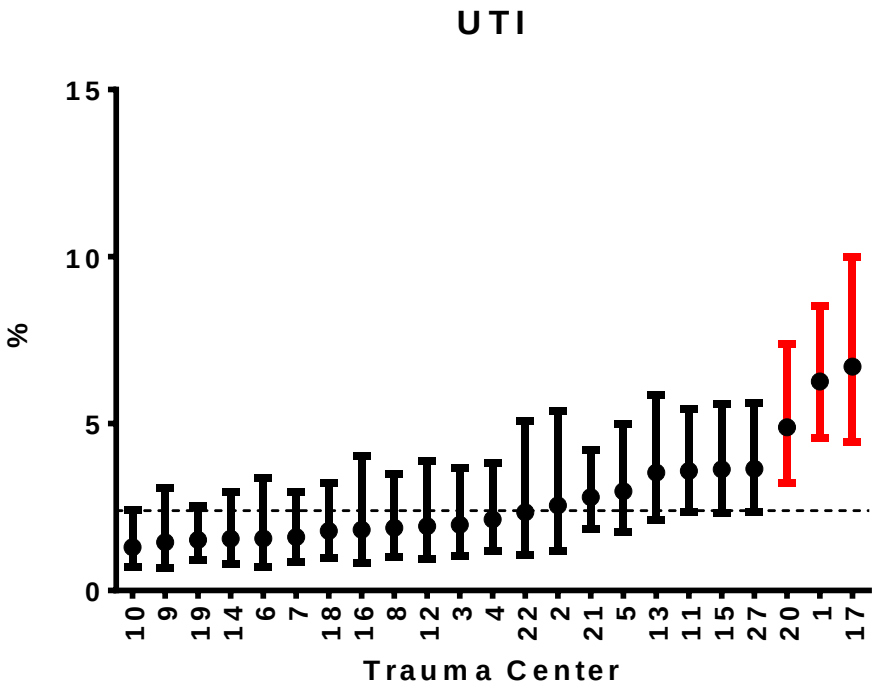
11/1/2011 to 10/31/2013





11/1/2011 to 10/31/2012

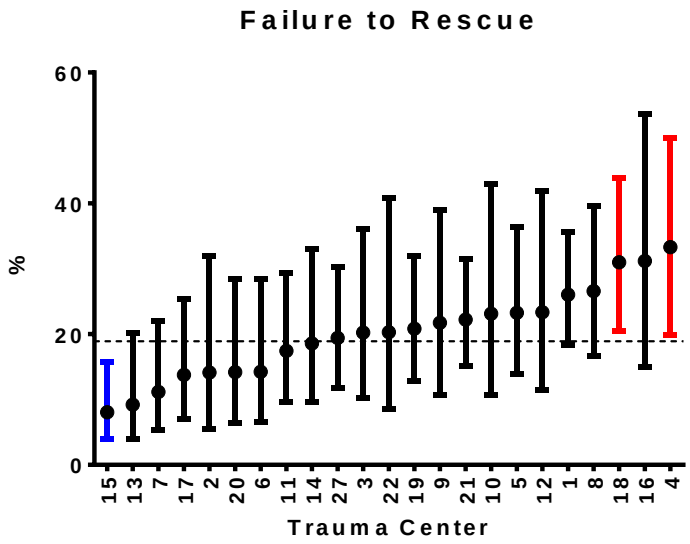


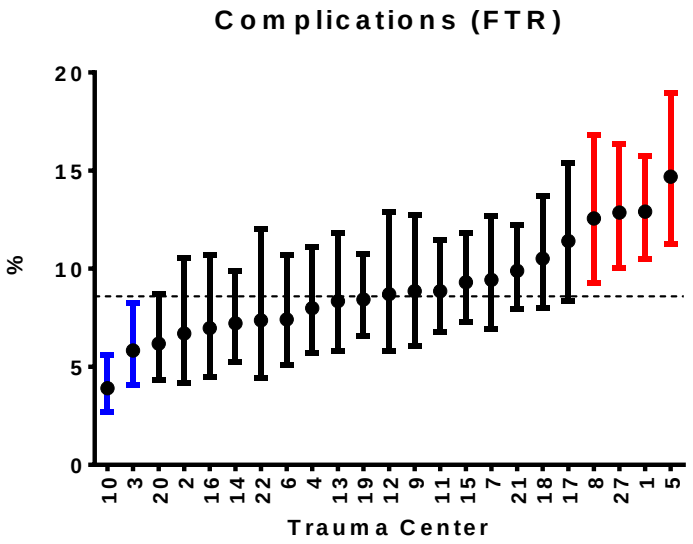


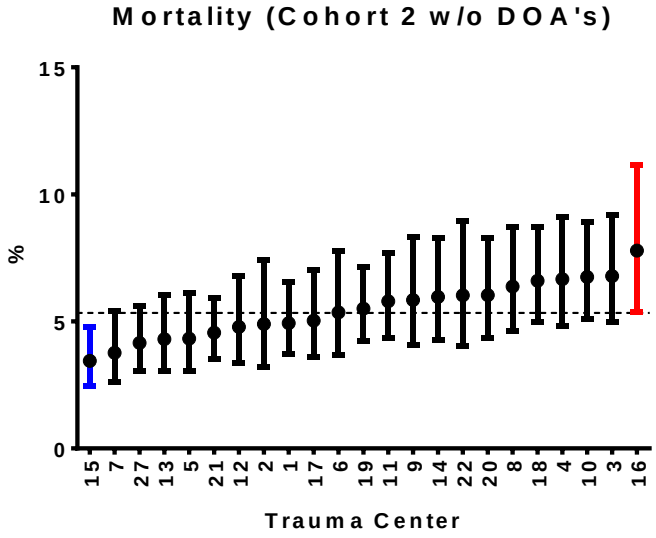
Failure to Rescue

- Failure to Rescue
  - Severity Grade 2 or 3 Complication
  - FTR = Dead with Severity Grade 2 or 3 Complication/N with Severity Grade 2 or 3 Complication

11/1/2011 to 10/31/2012







Brain Injury Monitors

- 11/1/11 to 10/31/12
- Procedure Data – (ICD-9)
  - Ventriculostomy (2.20, 1.26, 1.28)
  - Intraparenchymal pressure monitor (1.10)
  - Brain tissue oxygen monitor (1.16)
- MTQIP Process Measures Data

Brain Monitors (11/1/11 to 10/31/12)

Trauma Center	Any Monitor	Ventriculostomy	IPPM	02 Monitor	Jugular Venous Bulb
21	55	14	54	2	0
18	26	3	20	6	0
1	25	2	23	0	0
27	24	16	12	0	0
15	18	6	13	1	0
3	15	5	10	0	0
20	15	5	14	0	0
17	15	15	0	0	0
11	12	4	9	2	0
14	12	3	10	0	0
19	12	11	8	0	0
2	9	6	8	0	0
16	9	2	9	0	0
4	9	2	7	0	1
9	8	0	8	2	0
8	6	6	5	0	0
13	6	5	2	0	0
6	6	0	6	0	0
7	6	2	4	1	0
5	5	5	1	1	0
22	4	2	4	0	0
12	3	2	1	0	0
10	3	2	2	0	0
Total	303	118	230	15	1

Monitor for Head Injury

- 11/1/11 to 10/30/12
- Include if AIS Head > 0
- Exclude if
  - No signs of life
  - ED GCS > 8 and TBI GCS > 8
- Eligible = N - Alive w/o monitor - Dead and monitor withheld for reason
- Eligible and no monitor = N - Alive w/o monitor - Alive with monitor - Dead with monitor - Dead and monitor withheld for reason
- Reason monitor withheld

Monitor for Head Injury (11/1/2011 to 10/31/12)

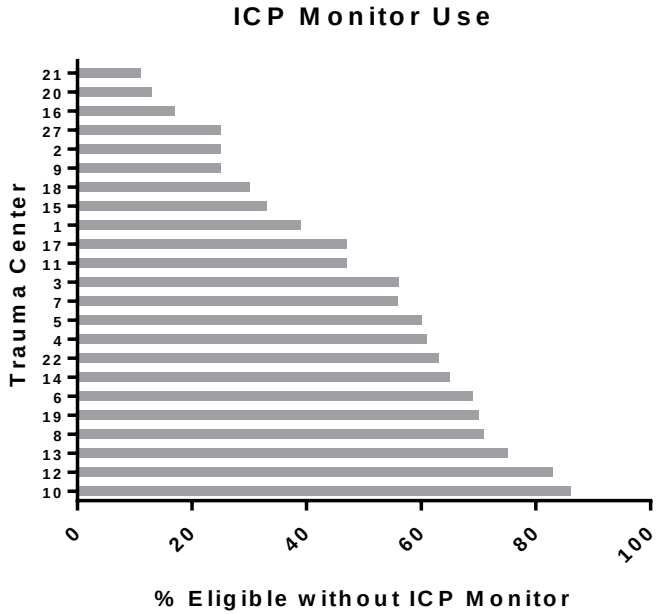
Inclusion:
AIS Head > 0

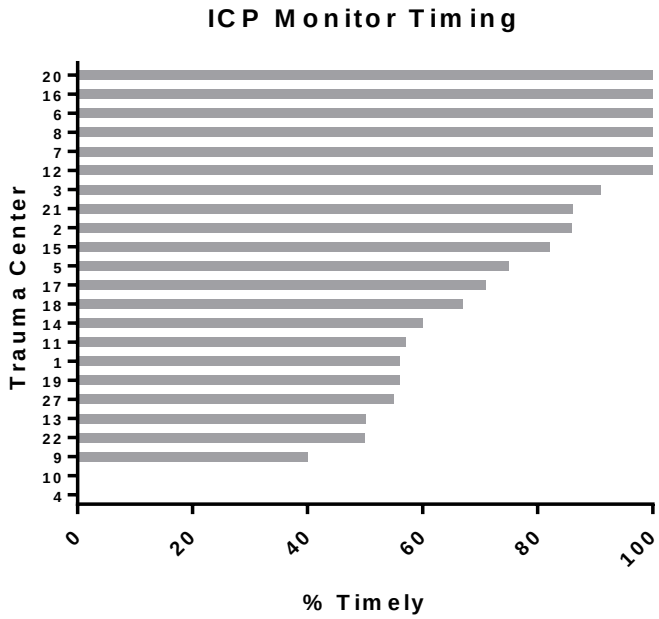
Exclusion:
No signs of life
ED GCS > 8 & TBI GCS > 8

Trauma Center	N	Dead	Alive w/o Monitor	Alive with Monitor	Dead w/o Monitor	Dead with Monitor	Dead and Monitor Withheld	Eligible & no Monitor	Eligible	% Eligible w/no Monitor	% Dead / N
21	88	35	20	33	19	16	13	6	55	11%	40%
27	73	20	36	17	16	4	9	7	28	25%	27%
19	70	32	29	9	29	3	1	28	40	70%	46%
1	57	25	19	13	19	6	7	12	31	39%	44%
18	55	21	21	13	13	8	4	9	30	30%	38%
11	51	16	29	6	12	4	3	9	19	47%	31%
3	49	20	22	7	15	5	0	15	27	56%	41%
17	41	13	22	6	11	2	4	7	15	47%	32%
4	38	16	18	4	13	3	2	11	18	61%	42%
13	35	14	19	2	12	2	0	12	16	75%	40%
14	35	12	18	5	11	1	0	11	17	65%	34%
15	34	8	15	11	7	1	1	6	18	33%	24%
10	29	13	15	1	12	1	0	12	14	86%	45%
2	27	8	13	6	5	3	2	3	12	25%	30%
7	26	10	13	3	9	1	4	5	9	56%	38%
20	25	10	7	8	4	6	2	2	16	13%	40%
5	23	6	13	4	6	0	0	6	10	60%	26%
6	22	13	6	3	11	2	0	11	16	69%	59%
9	21	8	9	4	6	2	4	2	8	25%	38%
8	18	11	6	1	10	1	5	5	7	71%	61%
16	15	6	6	3	4	2	3	1	6	17%	40%
12	12	9	3	0	8	1	3	5	6	83%	75%
22	11	7	2	2	6	1	1	5	8	63%	64%
Total	855	333	361	161	258	75	68	190	426	45%	39%

Reason ICP Monitor Withheld

	Alive	Dead	Total
Not known/Not recorded/Missing	330	190	520
Decision to withhold life sustaining measures	2	40	42
Death prior to correction of coagulopathy	1	24	25
Expected to improve within 8 hours due to effects of alcohol and/or drugs	8	0	8
Operative evacuation with improvement post-op	18	2	20
No ICP because of coagulopathy	2	2	4
Total	361	258	619


ICP Monitor Use
Trauma Center
21
20
16
27
2
9
18
15
1
17
11
3
7
5
4
22
14
6
19
8
13
12
10
0
20
40
60
80
100
% Eligible without ICP Monitor


ICP Monitor Timing
Trauma Center
20
16
6
8
7
12
3
21
2
15
5
17
18
14
11
1
19
27
13
22
9
10
4
0
20
40
60
80
100
% Timely

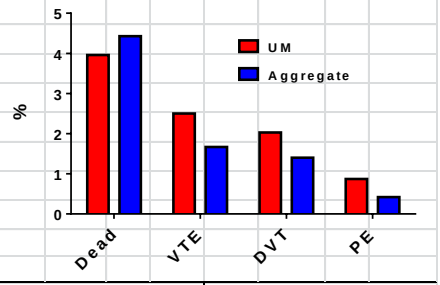
VTE

- Type Prophylaxis
  - None
  - Heparin SQ
  - LMWH SQ
- Timing
  - Timely (< 48 hrs after admission)

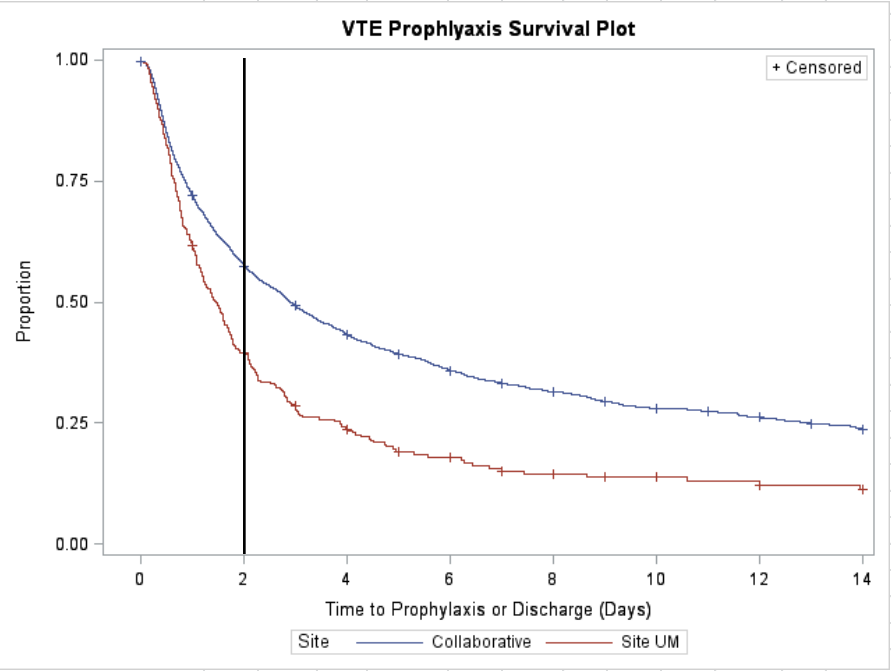
VTE Prophylaxis Type	Aggregate		Center	
	n	%	n	%
None	4354	48.1	141	29.0
≤48 Hours	3505	38.7	273	56.1
Heparin	1720	19.0	49	10.1
LMWH	1785	19.7	224	46.0
>48 Hours	1198	13.2	73	15.0
Heparin	466	5.1	7	1.4
LMWH	732	8.1	66	13.6
Total	9057	100.0	487	100.0

UM VTE Prophylaxis

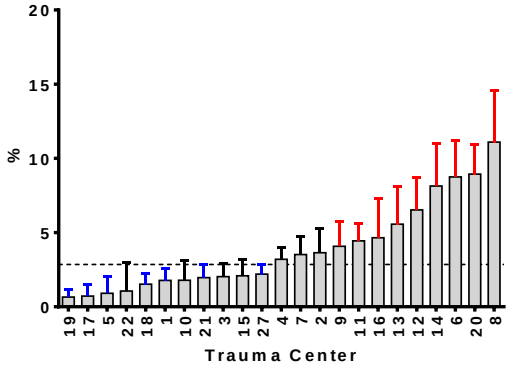
01/01/2012-10/31/12



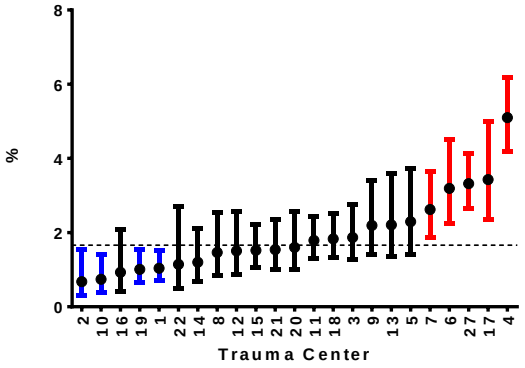
VTE Prophylaxis Type	VTE				DVT				PE			
	Aggregate		Center		Aggregate		Center		Aggregate		Center	
	n	%	n	%	n	%	n	%	n	%	n	%
None	24	0.6	1	0.7	17	0.4	1	0.7	9	0.2	0	0.0
Heparin	66	3.0	6	10.7	56	2.6	6	10.7	11	0.5	1	1.8
LMWH	64	0.0	5	0.03	56	2.2	2	0.7	14	0.6	4	1.4
Total	154	1.7	12	2.5	129	1.4	9	1.8	34	0.4	5	1.0



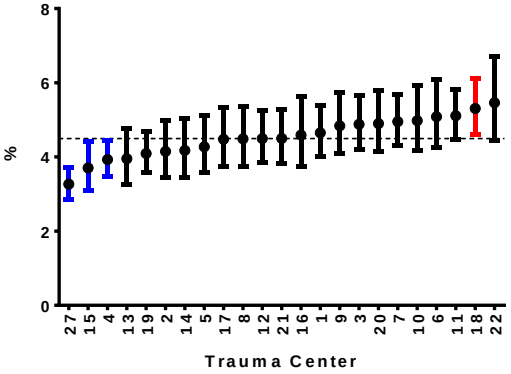
Risk and Reliability Adjusted IVC Filter Use



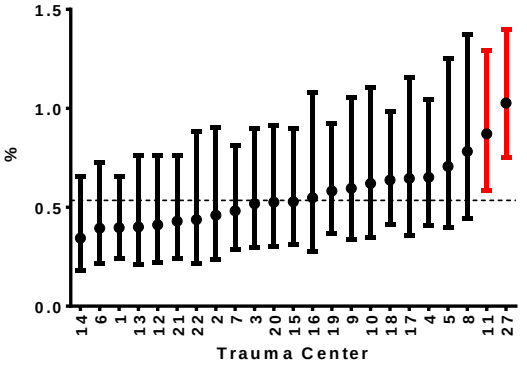
DVT



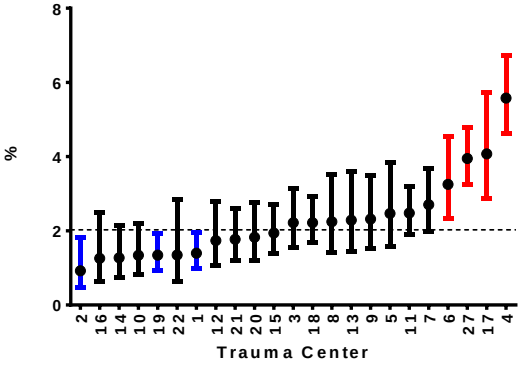
Mortality (Cohort 1 w/o DOA's)



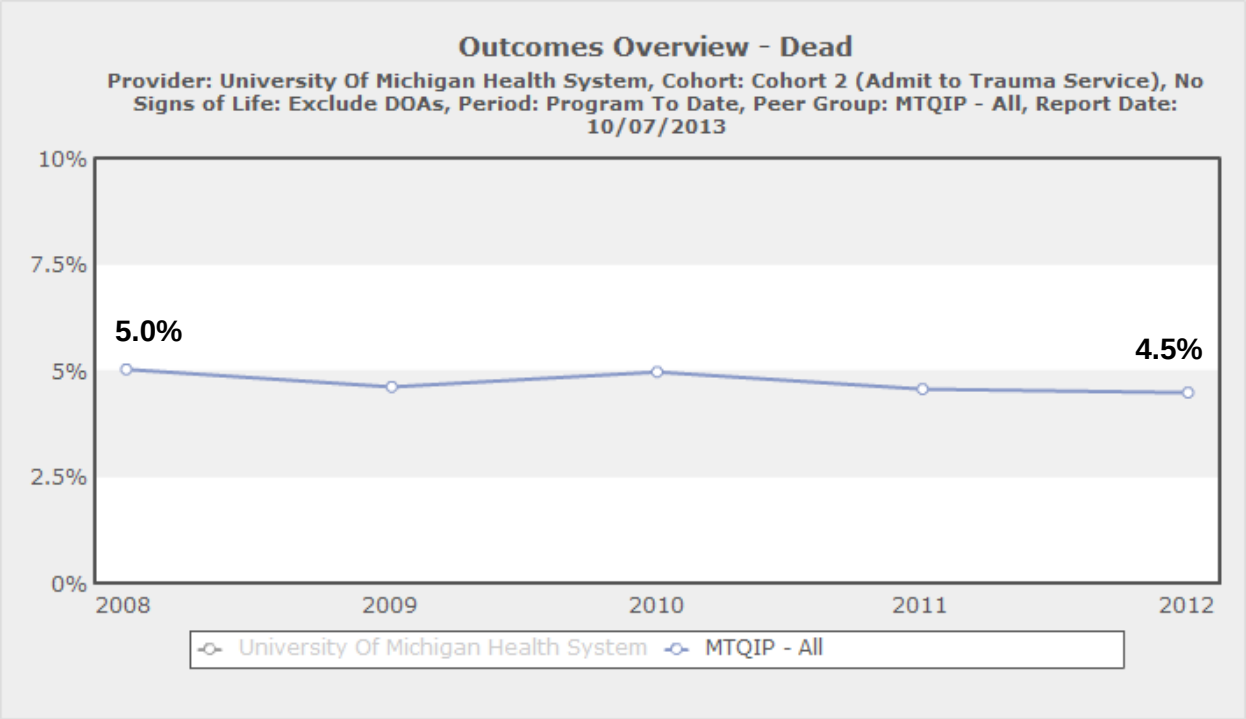
Pulmonary Embolus



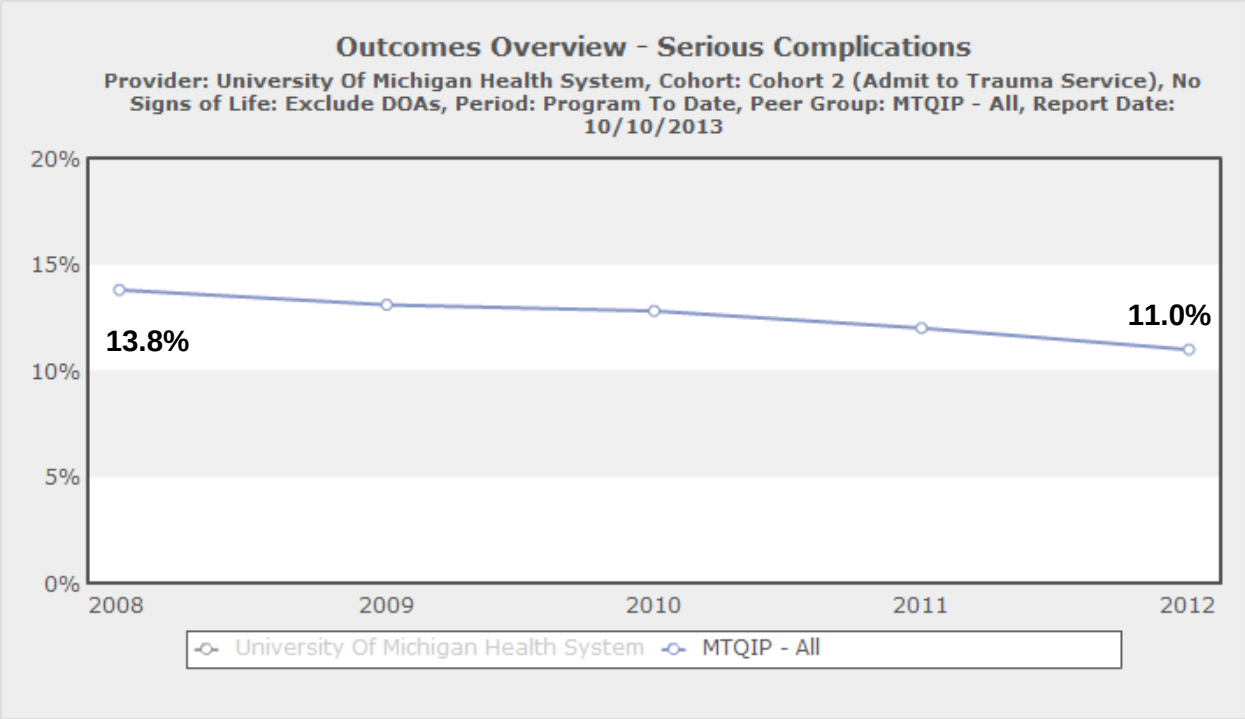
VTE



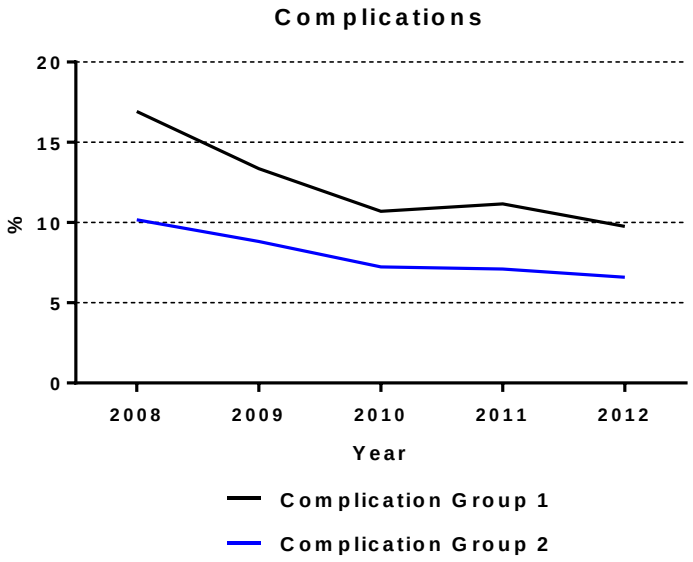
Mortality – Cohort 2 w/o/DOA (All Centers)

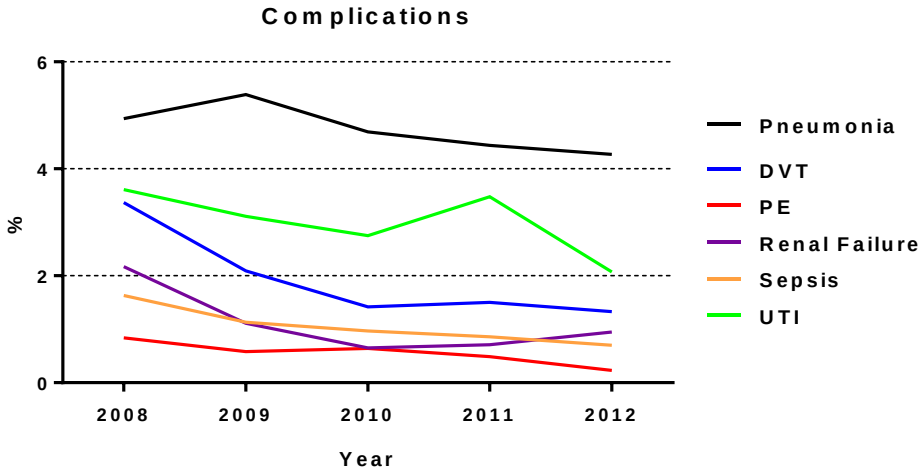


Serious Complications – Cohort 2 w/o/DOA (All Centers)



MTQIP – All Centers





Future Directions

- Data Transfer
- Need to run faster
- Currently lags 6-9 months
- Solutions
  - DI xml
    - Send Button
    - Completed cases, modified
  - Our own web-based registry
  - Other ideas

Future Directions

- Data Abstraction
- Low Yield Cases
  - 26,000 cases submitted
  - 10,000 ISS < 5, 38%
  - 16,000 cases
- Change abstraction criteria?
  - Short
  - Long
- Committee?

New Data Elements for 2014 (MTQIP)

- Responding/Admitting Surgeon
- Crystalloid
  - Only patients receiving blood in first 24 hrs
  - Total IVF Pre-hospital
  - Total IVF in 4hrs or Pre-blood
  - Total IVF in 24hrs
  - Conversion table for colloids
  - Nearest liter
- Complication
  - Renal Insufficiency

New Data Elements for 2014 (NTDS)

- Abuse Fields
- Revisions to Hospital Discharge Disposition
- Trauma Triage Criteria (CDC)
- ICD-10, Required for 2015 admissions
- AIS 05, Required for 2015 admissions

CQI Scoring

Proposed 2014 MTQIP Hospital Metrics

Measure	Weight	Measure Description			Points
PARTICIPATION (70%)					
#1	10	**Data Submission**			
		On time 3 of 3 times			10
		On time 2 of 3 times			5
		On time 1 of 3 times			0
#2	20	**Meeting Participation – Surgeon Lead**			
		Participated in 3 of 3 meetings			20
		Participated in 2 of 3 meetings			10
		Participated in 1 of 3 meetings			5
		No participation			0
#3	20	**Meeting Participation – Trauma Manager/Registrar (Avg)**			
		Participated in 3 of 3 meetings			20
		Participated in 2 of 3 meetings			10
		Participated in 1 of 3 meetings			5
		No participation			0
#4	10	**Site Specific Quality Improvement Project Implementation**			
		Project data submitted			10
		Project data not submitted			0
#5	10	**Surgeon Lead Presents MTQIP Reports at Hospital Meetings**			
		Presented at 3 meetings			10
		Presented at 2 meetings			8
		Presented at 1 meeting			5
		Did not present			0
		*Signed attestation required			
PERFORMANCE (30%)					
#6	10	**Accuracy of Data**			
			Visit #1	**Visit #2 or More**	
		5 star validation	0-4.5%	0-4.5%	10
		4 star validation	4.6-5.5%	4.6-5.5%	8
		3 star validation	5.6-8.0%	5.6-7.0%	5
		2 star validation	8.1-9.0%	7.1-8.0%	3
		1 star validation	> 9%	> 8.0%	0
#7	10	**Massive Transfusion (defined as ≥ 4 u PRBC in first 4 hours): 24 Hour (Mean) PRBC to Plasma Ratio**			
		≤ 1.5			10
		1.6 - 2.5			7.5
		> 2.5			5
		> 3.0			0
#8	10	**Timely VTE Prophylaxis (< 48 hours of admission)**			
		> 50%			10
		≥ 40%			5
		< 40%			0

Program Manager

Judy Mikhail, RN

ACS TQIP Meeting

- Phoenix, Arizona
- November 17-19, 2013
- Sunday am: new centers
- Topics
  - TBI
  - Massive Transfusion
- Mix of clinical, PI, registry topics
- TD, TPM, Registrar encouraged to attend
- 2 paid participants per center
- Travel unfortunately not covered

MTQIP Site Visits

- 10 Centers visited to date
  - Beaumont
  - Borgess
  - Bronson
  - Detroit Receiving
  - Genesys
  - Henry Ford
  - McLaren Oakland
  - Munson
  - Sinai-Grace
  - Sparrow
- Customer service visit
- Face to face
- Get to know you
- Answer questions
- Identify concerns
- Future meeting ideas

Resource Benchmarking

MTQIP Hospital #	Admitted Trauma Volume	Trauma Surgeons (TS)											
		Total Surgeon Positions	Priv Prac	Hosp Emp	Locums	Vacancies Not Currently Covered	In-house trauma call required	# Surgeons with Critical Care Boards	# Surgeons Who Also Take EGS Call	What % EGS Call Covered by Trauma Surgeons	Simul-taneous Trauma & EGS Call	Percent trauma & general surgery patients managed by surgeons	Primary surgical ICU open or closed?
21	1700	9	9	0	0	0	Y	3	8	100%	Y	100%	Open
22	537	8	2	3	0	3	N	0	2	100%	Y	100%	Open
16	630	9	9	0	0	0	N	2	9	100%	Y	100%	Open
8	859	6	6	0	0	0	N	0	6	60%	Y	100%	Open
15	1984	9	9	0	0	0	Y	5	2	25%	N	95%	Closed
6	700	7	6	1	0	0	Y	0	7	100%	Y	100%	Open
14	648	9	3	6	0	0	Y	3	8	73%	Y	100%	Open
13	1101	10	10	0	0	0	Y	2	10	100%	Y	100%	Closed
11	1764	9	0	9	0	0	Y	9	9	100%	Y	100%	Open
19	2650	8	3	5	0	0	Y	5	0	0%	N	100%	Closed
12	982	5	5	0	0	0	N	1	5	100%	Y	100%	Open
7	1239	11	6	4	0	1	N	4	9	100%	Y	100%	Closed
3	1350	5	0	5	0	0	Y	2	4	20%	N	95%	Open
9	595	7	0	5	1	1	Y	2	5	35%	Y	100%	Closed
27	1410	10	0	10	0	0	N	9	10	50%	Y	100%	Closed
17	769	7	7	0	0	0	N	2	7	50%	N	70%	Open
1	2700	9	9	0	0	0	N	4	0	0%	N	100%	Open
4	1400	5	5	0	0	0	N	5	5	0%	Y	80%	Closed
10	1975	9	7	2	0	0	N	2	8	85%	Y	91%	Open
20	1375	9	9	0	0	0	N	1	9	90%	Y	100%	Open
2	676	7	2	4	1	0	N	4	4	75%	Y	80%	Open
18	1461	6	0	3	2	1	Y	2	3	75%	Y	95%	Open
5	1609	5	4	1	0	0	Y	0	5	50%	N	95%	Open
Total	30114	179	111	58	4	6	N=52%	67	135	1488	Y=74%	96%	O=70%

Total Non Clinical Staff Per Program

Hospital	Volume	**Total**
MTQIP Hospital # (Adult Programs Only)	Most recent total admitted trauma volume	Total # Positions
4	1400	3.80
1	2700	7.00
17	769	4.00
21	1700	5.00
16	630	2.35
8	859	4.00
15	1984	5.00
6	700	2.50
14	648	6.00
13	1101	3.00
11	1764	7.00
19	2650	4.50
12	982	3.00
7	1239	5.00
3	1350	7.70
27	1410	10.50
22	537	2.50
9	595	4.00
10	1975	4.00
20	1375	2.98
18	1461	4.00
2	676	3.40
5	1609	4.00

Individual PI Projects

- Submissions timely
- Good projects
- Project categories
  - Complications
  - Length of stay
  - Anticoagulant Reversal
  - Practice Issues
- Hardwire PI
- Complements
  - Verification
  - Hospital PI efforts
- Opportunity to showcase projects
- Dissemination of information

Research Projects

- Motorcycle Helmet Study
- Data recently submitted
- Thanks to those that have sent in
- Project underway
- Analysis within next 6 months

Future Meetings

- Tuesday February 11, 2014
  - Location: Ann Arbor/Ypsilanti
- Wednesday May 14, 2014
  - Location: Petoskey
- Tuesday June 3, 2014
  - Location: Ann Arbor
  - Registrar's
- Tuesday October 14, 2014
  - Location: Ann Arbor/Ypsilanti

Conclusion

- CME
  - On way out
- MTQIP Reports
  - On way out
- Evaluations
  - Program questions from BC