The Michigan Trauma Quality Improvement Program

Ypsilanti, MI
February 2, 2016

Disclosures

- Salary Support for MTQIP from BCBSM/BCN
  - Mark Hemmila
  - Judy Mikhail
  - Jill Jakubus
  - Anne Cain-Nielsen

Welcome/Introductions

- MTQIP Clinical Reviewers
- New Centers
  - Providence-Providence Park Hospital, Novi
  - St. Marys Mercy Livonia Hospital, Livonia
- State of Michigan Trauma Epidemiologist
  - Allen Stout, MS

Welcome/Introductions

- Guest Speakers
- Himanshu Patel, MD
  - University of Michigan, Cardiac Surgery
  - Blunt Traumatic Aortic Injury
- Elliott Haut, MD
  - Johns Hopkins University, Acute Care Surgery
  - Venous Thromboembolism

ACS-TQIP

- Center Report
  - Fall 2015
  - Spring 2016
- Michigan Report
  - Today
- No Invoices
  - 2015
  - 2016

Data Submission

- DI
  - V5
  - ?
- CDM
  - Contract signed
  - Target June 2016
- February Submission
  - 7/1/2014 to 10/30/2015 (minimum)

Future Meetings

- Spring
  - Wednesday May 18, 2016
  - Mackinaw Island, Mission Point Resort
- Spring with MANS
  - Friday May 20, 2015
  - Petoskey, Bay Harbor Resort,
- Spring (Registrars and MCR's)
  - Tuesday June 7, 2016
  - Ann Arbor, NCRC

MTQIP/MANS

- Meeting
  - Friday May 20, 2016
  - Petoskey, Bay Harbor Resort
- Attendees
  - Neurosurgeons
  - TPD, TPM, MCR
- Accommodations
  - Hotel covered on Thurs night
  - Contact Jennifer O'Gorman

MTQIP/MANS

- Planning
  - Neurosurgeons
    - Robert Johnson, MD
    - Rick Olsen, MD
    - Jason Heth, MD
    - Sanjay Patra, MD
  - MTQIP Advisory Committee
  - You

MTQIP/MANS - Summary

- MTQIP Data
- Perspectives
- Survey
- Controversial Topics
  - Panel

https://mansmtqipjointmeeting.splashthat.com/

MCR Survey Results
MTQIP 2015 and 2016
CQI Performance Index Scoring

Judy Mikhail, PhD, MBA, RN

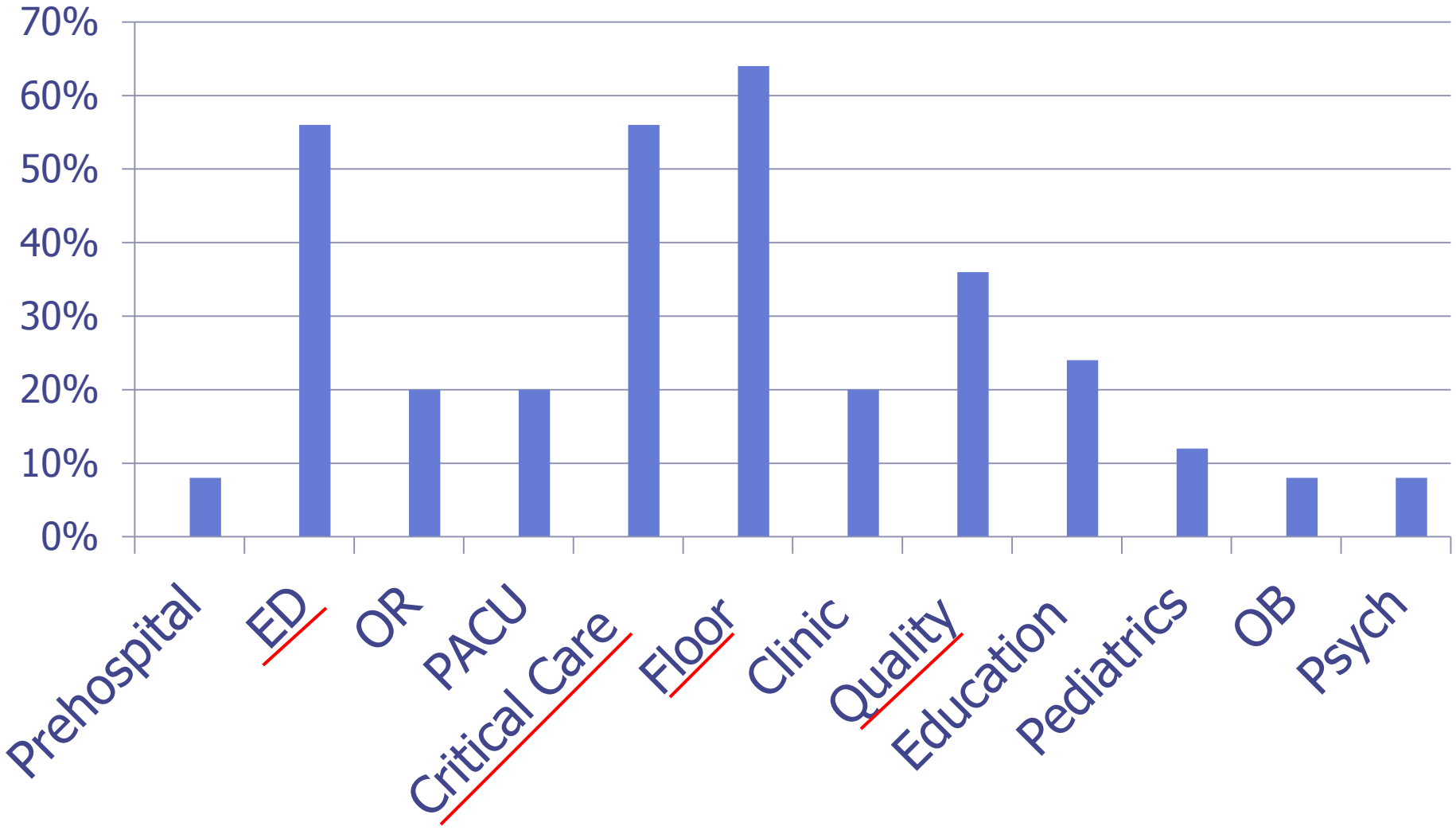
WELCOME: 30 NEW MCR'S

MCR SURVEY

MCR Nursing Experience

- Combined RN Experience (yrs): 388
- Average (yrs): 16
- Range (yrs) : 5-34

MCR Work Experience



MCR Trauma Experience

- Rate your experience caring for trauma patients (1 low to 5 high)
  - Low 4
  - Moderate 10
  - High 11
  - Weighted Average: 4.24

MCR QI Experience

- Rate your experience with quality improvement activities (1 low to 5 high)
  - Low 4
  - Occasional 5
  - Moderate 11
  - High 5
  - Weighted Average: 3.68

MCR Support

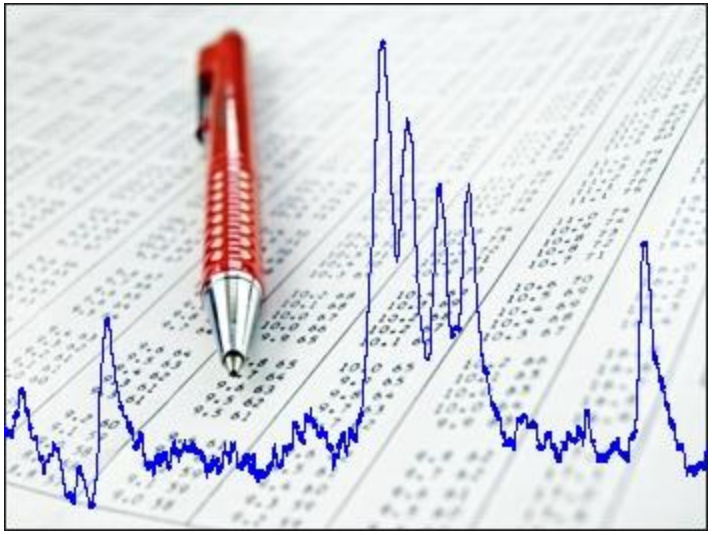
Mentoring

- One on one mentoring
- Monthly conference calls
- Blue Jeans Conferencing
- Lecture series
- What ever it takes….

Communication Clarification

- MCR's and TPM's

2016 Performance Index Results



2016 Performance Index

Measure	Weight	Measure Description	Points	
#1	10	**Data Submission (No points for partial/incomplete submissions)**		PARTICIPATION (50%)
		On time and **complete** 3 of 3 times	10	
		On time and **complete** 2 of 3 times	5	
		On time and **complete** 1 of 3 times	0	
#2	20	**Meeting Participation-Surgeon**		
		Participated in 3 of 3 meetings	20	
		Participated in 2 of 3 meetings	10	
		Participated in 1 of 3 meetings	5	
		Participated in 0 of 3 meetings	0	
#3	10	**Meeting Participation-Clinical Reviewer or Trauma Program Manager**		
		Participated in 3 of 3 meetings	15	
		Participated in 2 of 3 meetings	10	
		Participated in 1 of 3 meetings	5	
		Participated in 0 of 3 meetings	0	
#4	10	**Meeting Participation-Trauma Registrar(s)**		
		Participated in the annual June Registrar meeting	5	
		Did not participate	0	

2016 Performance Index

Measure	Weight	Measure Description	Points
#1	10	**Data Submission (No points for partial/incomplete submissions)**	
		On time and **complete** 3 of 3 times	10
		On time and **complete** 2 of 3 times	5
		On time and **complete** 1 of 3 times	0

Example: If call for data is for 3/1/14 -6/30/15

To receive points you should submit cases into <u>June 2015</u>

PARTICIPATION (50%)

2016 New Addition

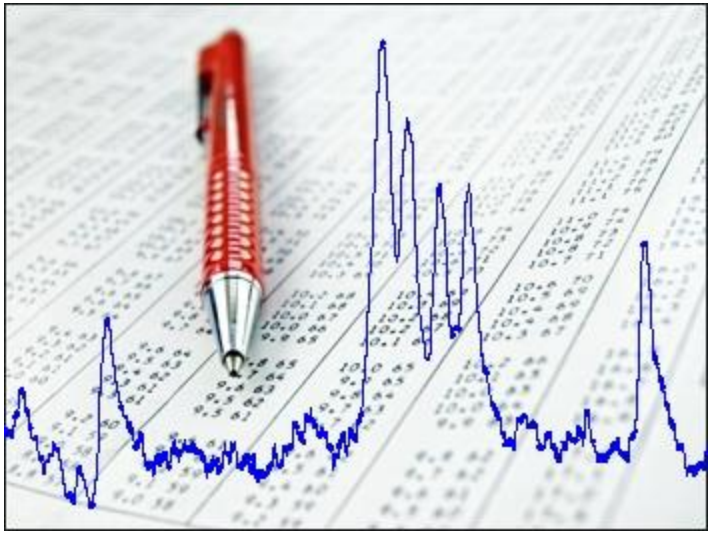
Collaborative Wide Initiative:
Graded as a Group not as Individual Center

We only succeed if we all succeed

2016 Performance Index

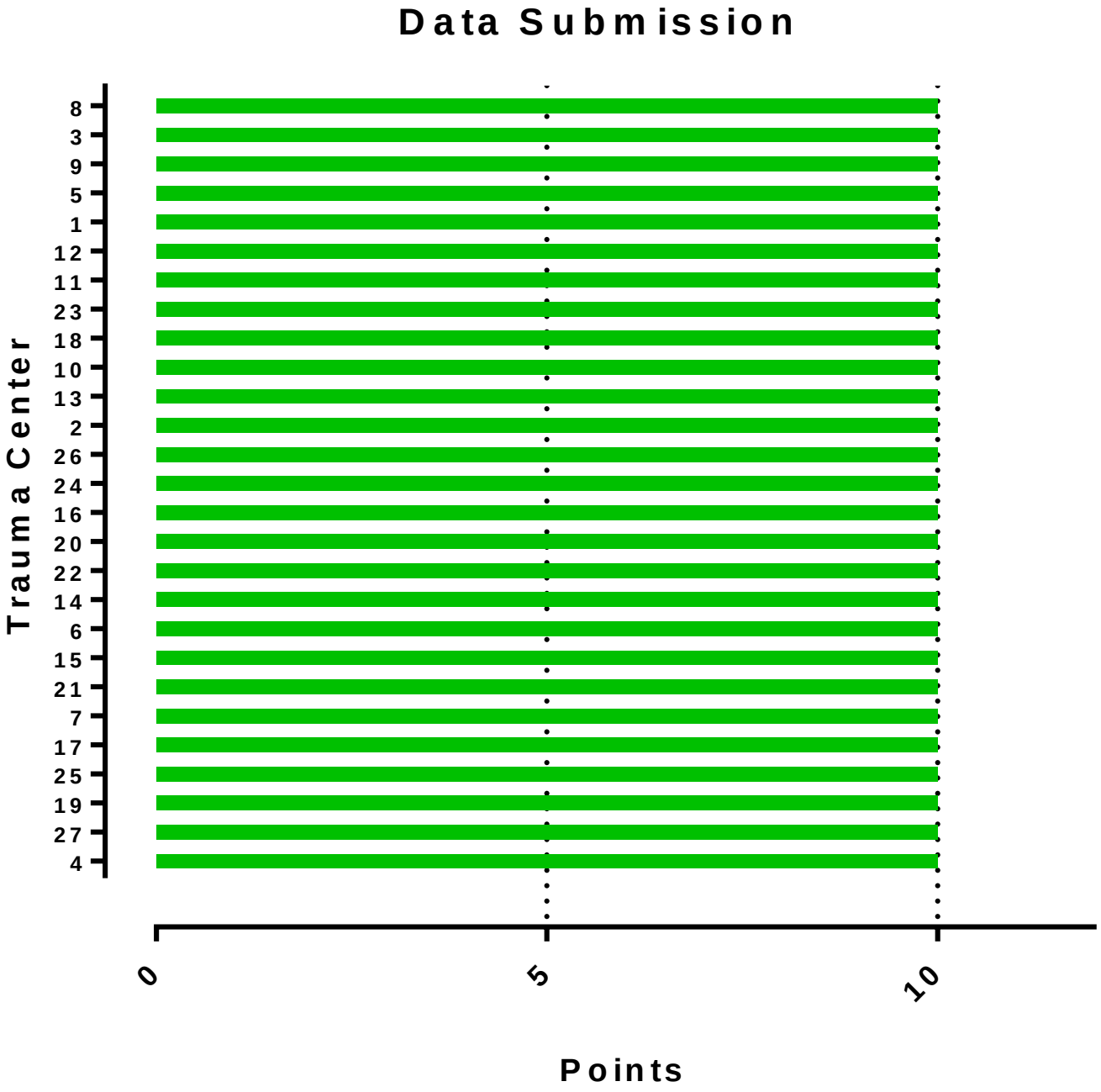
#5	10	**Data Accuracy**	**First Validation Visit Error Rate**	**Two or > Validation Visits Error Rate**		**PERFORMANCE (50%)**
		5 Star Validation	0-4.5%	0-4.5%	10	
		4 Star Validation	4.6-5.5%	4.6-5.5%	8	
		3 Star Validation	5.6-8.0%	5.6-7.0%	5	
		2 Star Validation	8.1-9.0%	7.1-8.0%	3	
		1 Star Validation	>9.0%	>8.0%	0	
#6	10	**Site Specific Quality Initiative Using MTQIP Data**				
		Developed and implemented with evidence of improvement			10	
		Developed and implemented with no evidence of improvement			5	
		Not developed or implemented			0	
#7	10	**Mean Ratio of Packed Red Blood Cells (PRBC) to Fresh Frozen Plasma (FFP) in Patients Transfused ≥5 Units RBC In First 4 Hrs (18 Months Data)**			0-10	
		Tier 1: ≤ 1.5			10	
		Tier 2: 1.6-2.0			10	
		Tier 3: 2.1-2.5			5	
		Tier 4: >2.5			0	
#8	10	**Admitted Patients (Trauma Service-Cohort 2) With Initiation of Venous Thromboembolism (VTE) Prophylaxis <48 Hours After Arrival (18 Months Data)**				
		>50%			10	
		≥40%			5	
		<40%			0	
#9	10	**COLLABORATIVE WIDE INITIATIVE: Inferior Vena Cava Filter Use**				
		≤1.5			10	
		>1.5			0	

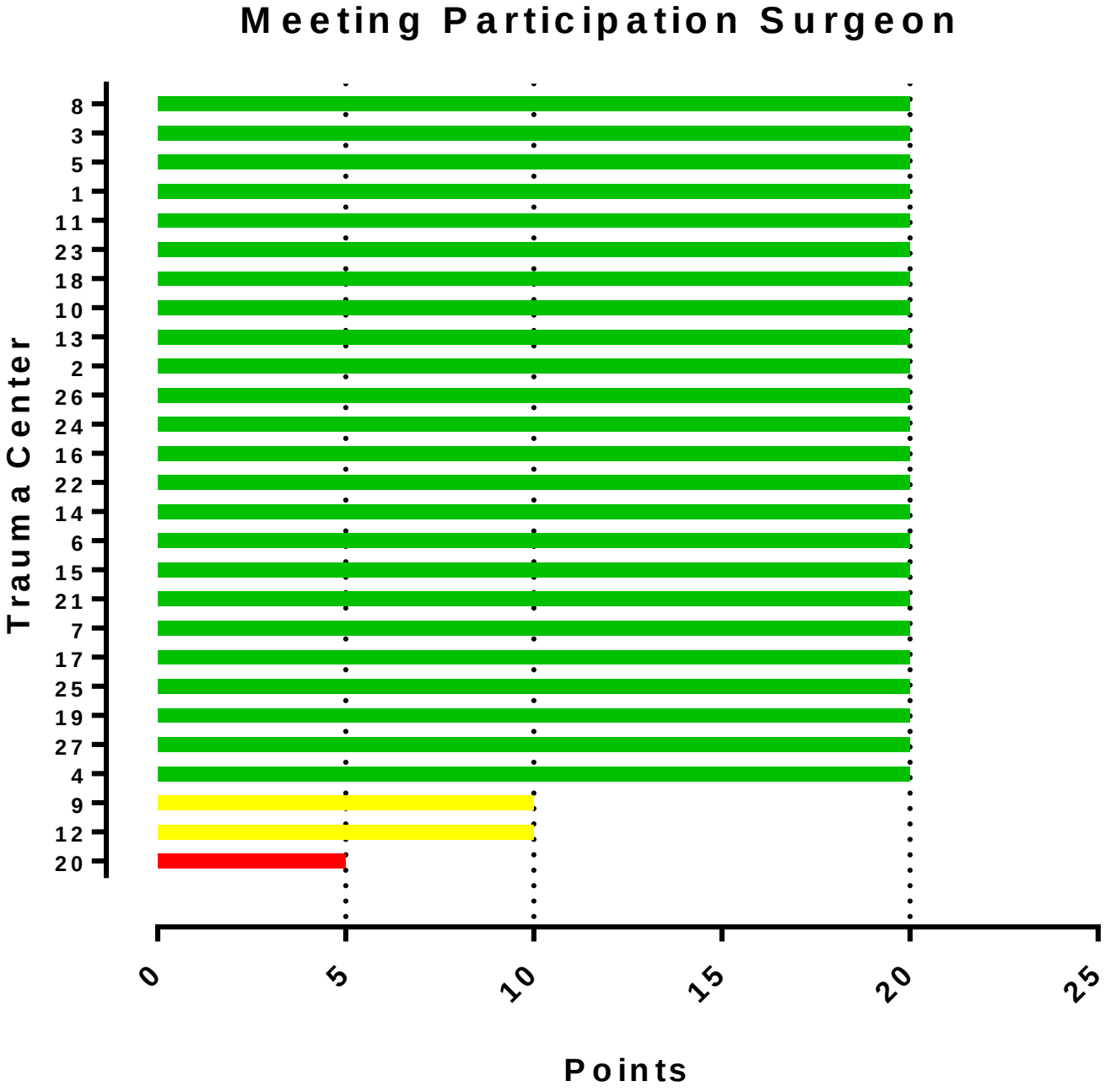
2015 Performance Index Results

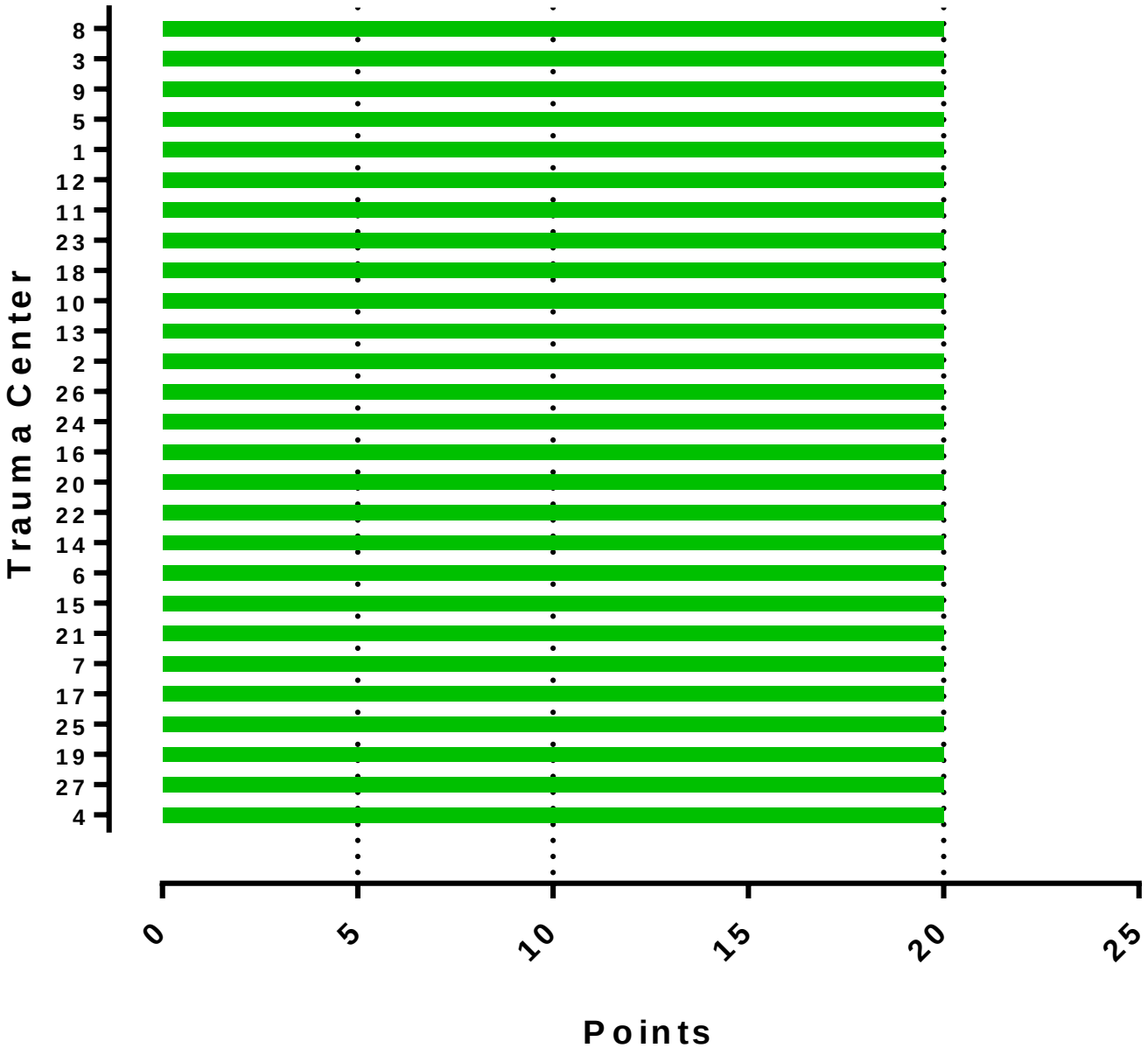


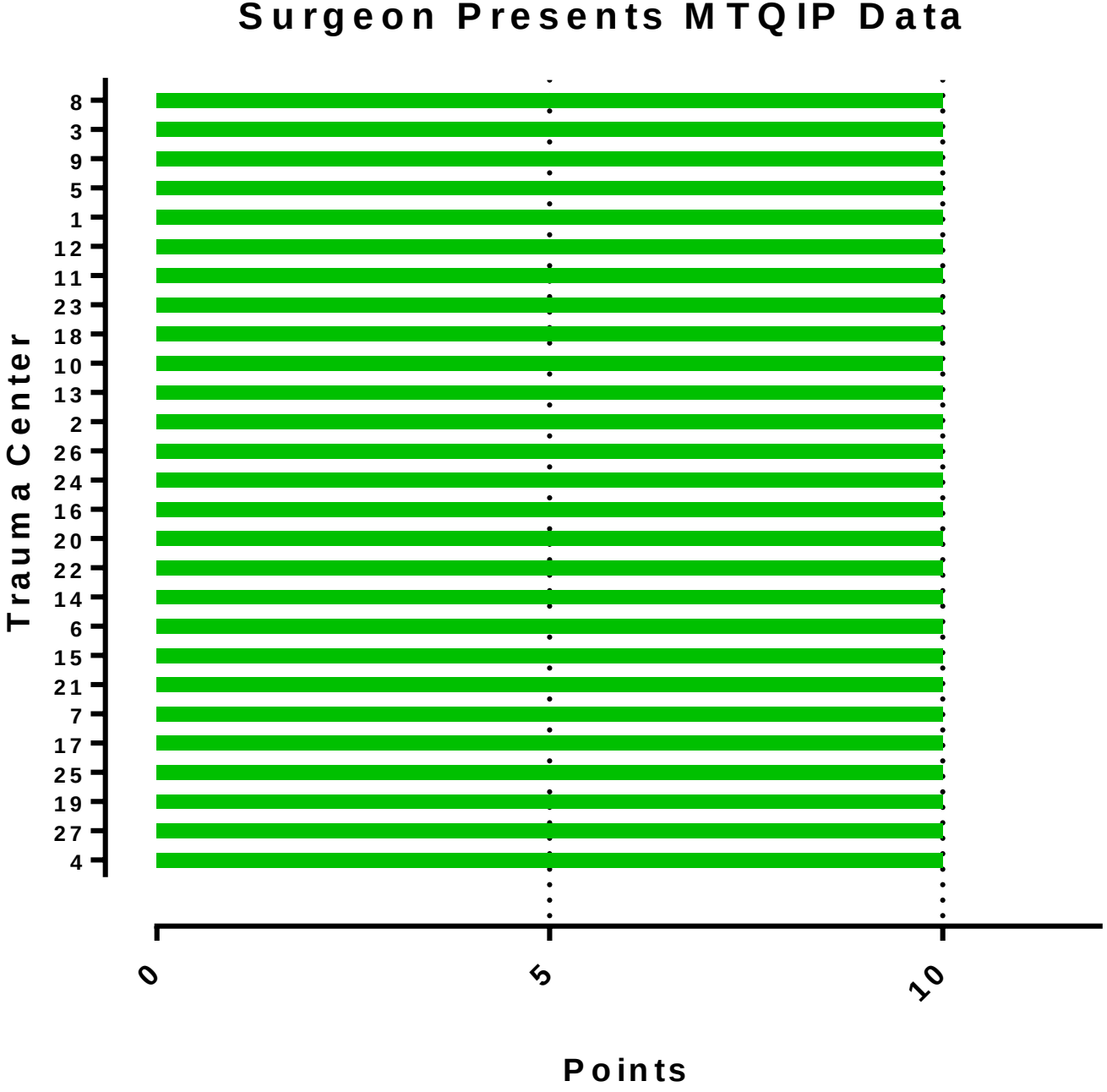
MTQIP 2015 CQI Performance Index

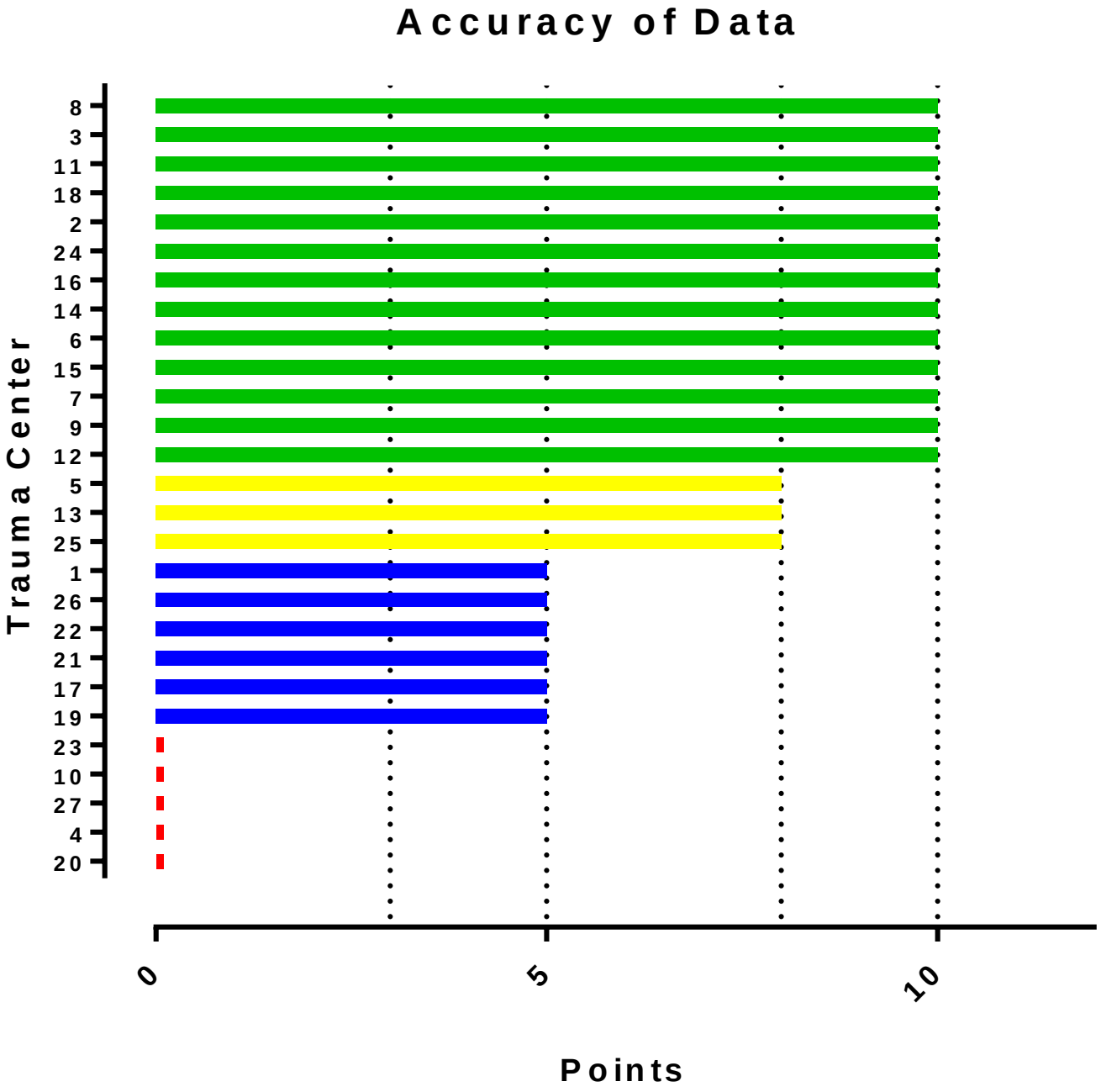
- Participation 60%
  - Data Submission
  - Surgeon Lead
  - Trauma Program Manager/Registrar
  - **Presentation/Use of MTQIP data (last year)**
- Performance 40%
  - Data Validation
  - Site-specific QI project
  - Massive Transfusion Protocol
  - VTE Prophylaxis

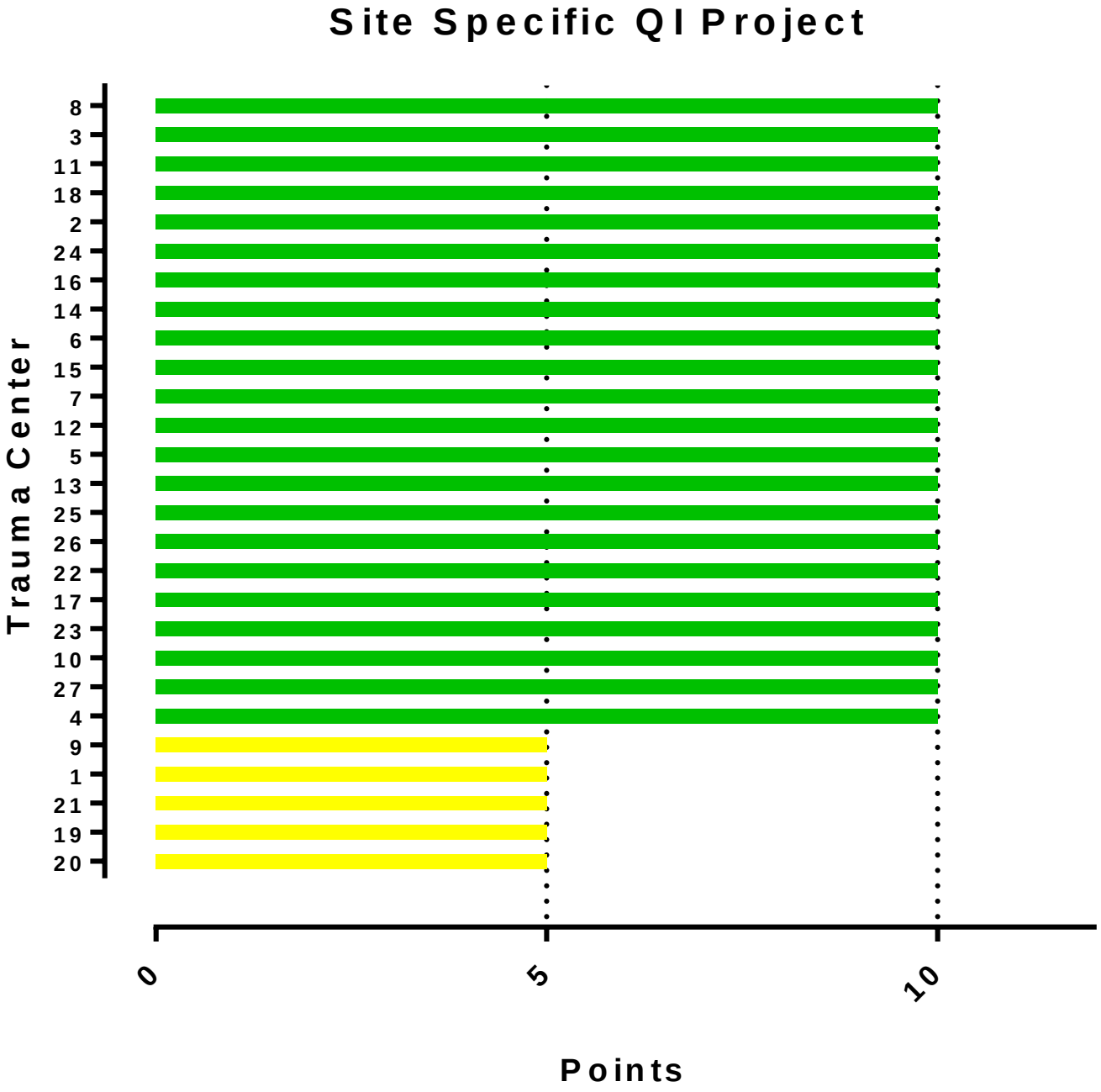

Data Submission
Trauma Center
8
3
9
5
1
12
11
23
18
10
13
2
26
24
16
20
22
14
6
15
21
7
17
25
19
27
4
0
5
10
Points

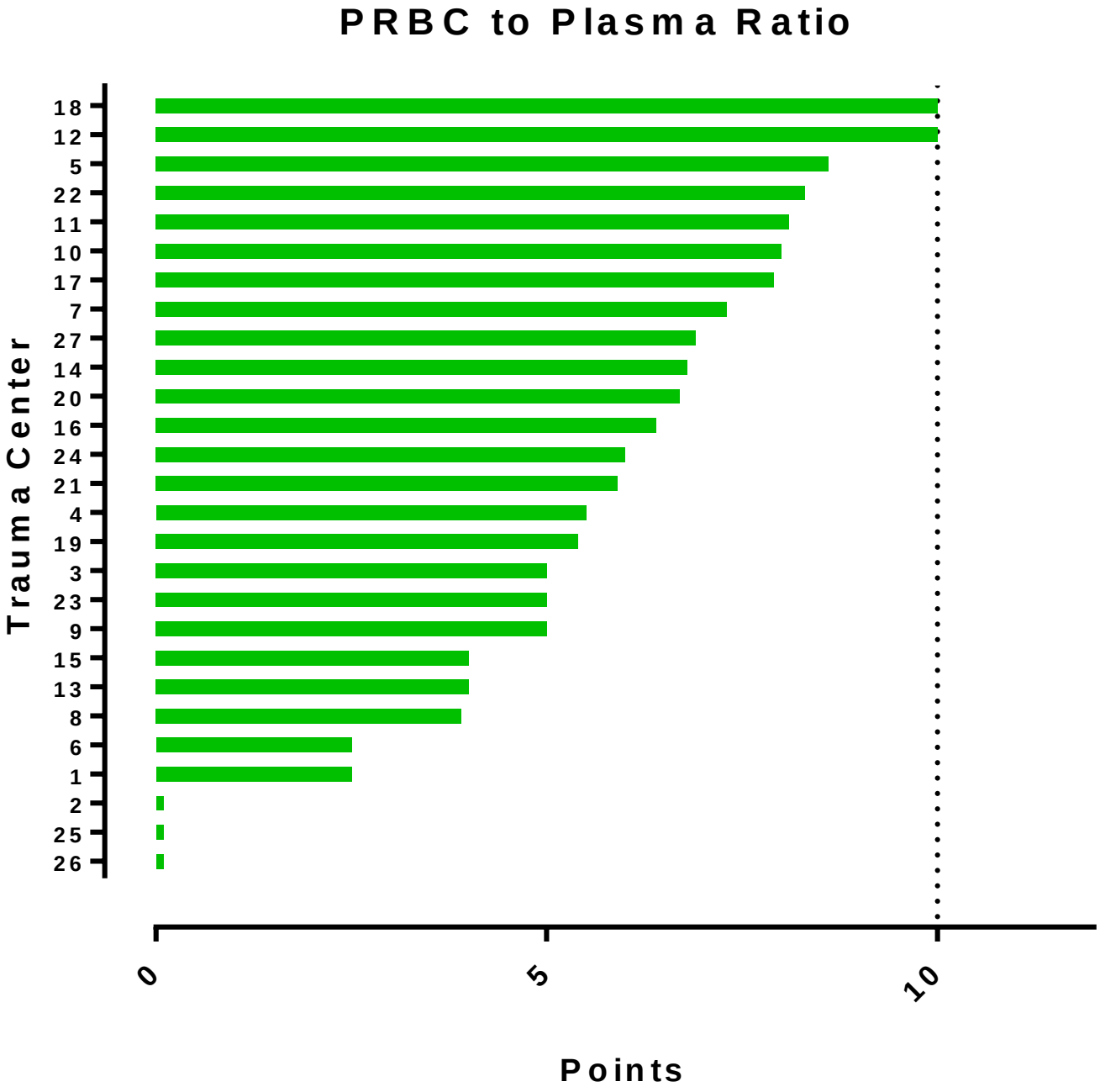

Meeting Participation Surgeon
Trauma Center
8
3
5
1
11
23
18
10
13
2
26
24
16
22
14
6
15
21
7
17
25
19
27
4
9
12
20
0
5
10
15
20
25
Points

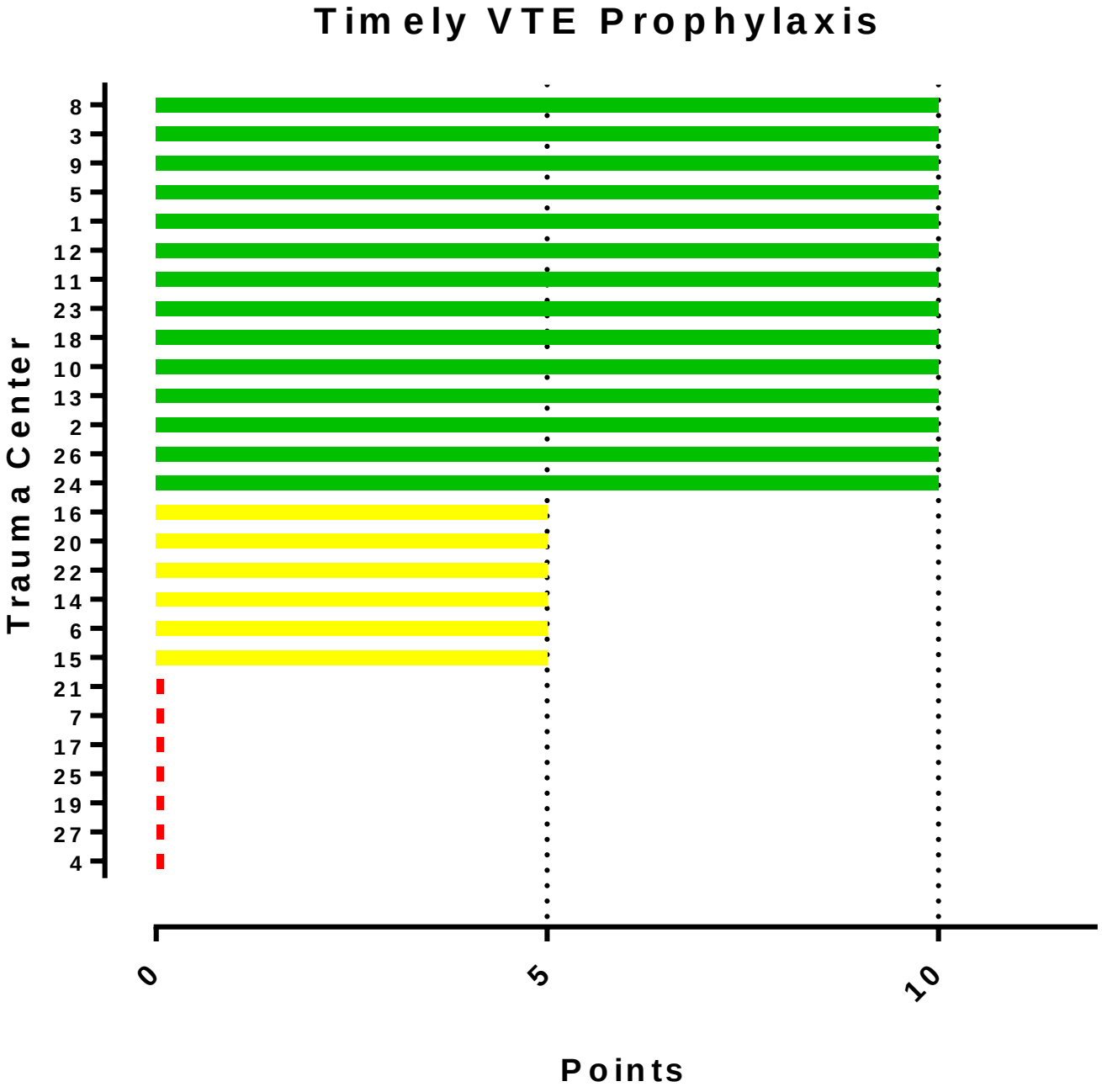

Meeting Participation Mang./Reg.
Trauma Center
8
3
9
5
1
12
11
23
18
10
13
2
26
24
16
20
22
14
6
15
21
7
17
25
19
27
4
0
5
10
15
20
25
Points

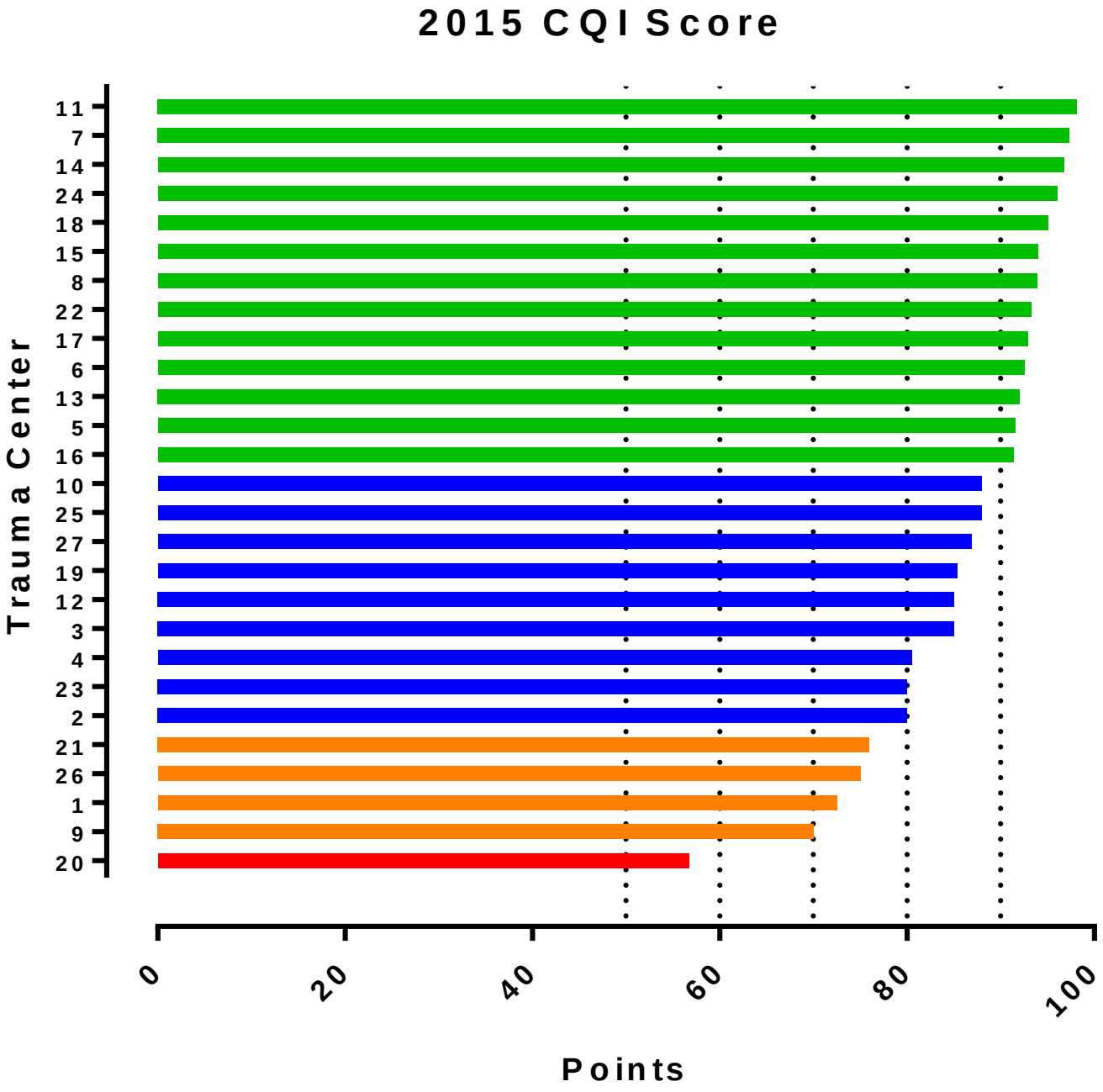

Surgeon Presents MTQIP Data
Trauma Center
8
3
9
5
1
12
11
23
18
10
13
2
26
24
16
20
22
14
6
15
21
7
17
25
19
27
4
0
5
10
Points

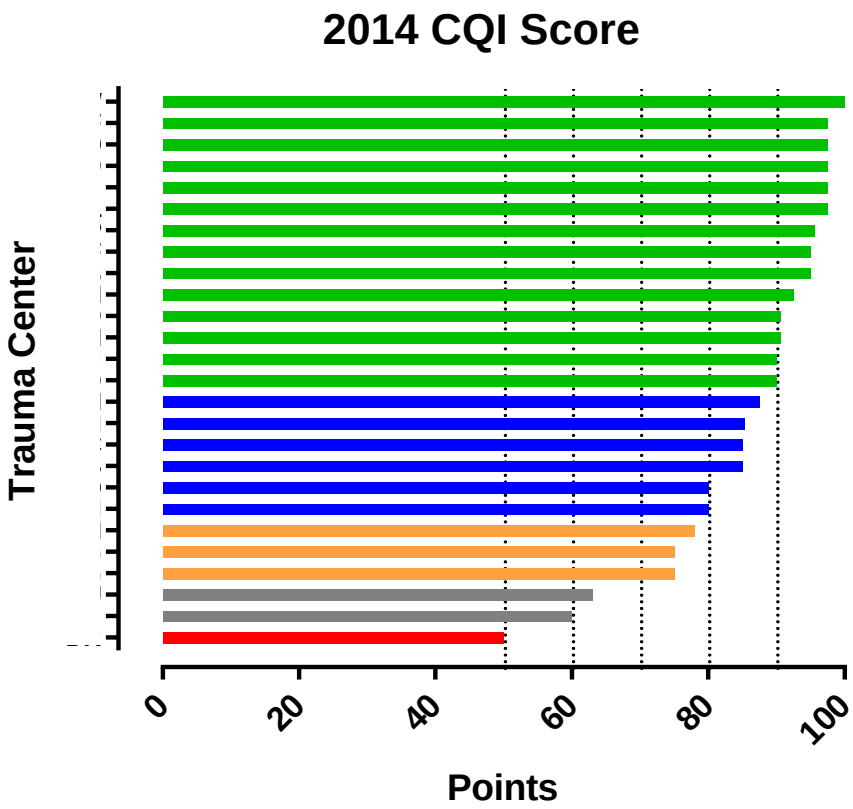

Accuracy of Data
Trauma Center
8
3
11
18
2
24
16
14
6
15
7
9
12
5
13
25
1
26
22
21
17
19
23
10
27
4
20
0
5
10
Points


Site Specific QI Project
Trauma Center
8
3
11
18
2
24
16
14
6
15
7
12
5
13
25
26
22
17
23
10
27
4
9
1
21
19
20
0
5
10
Points

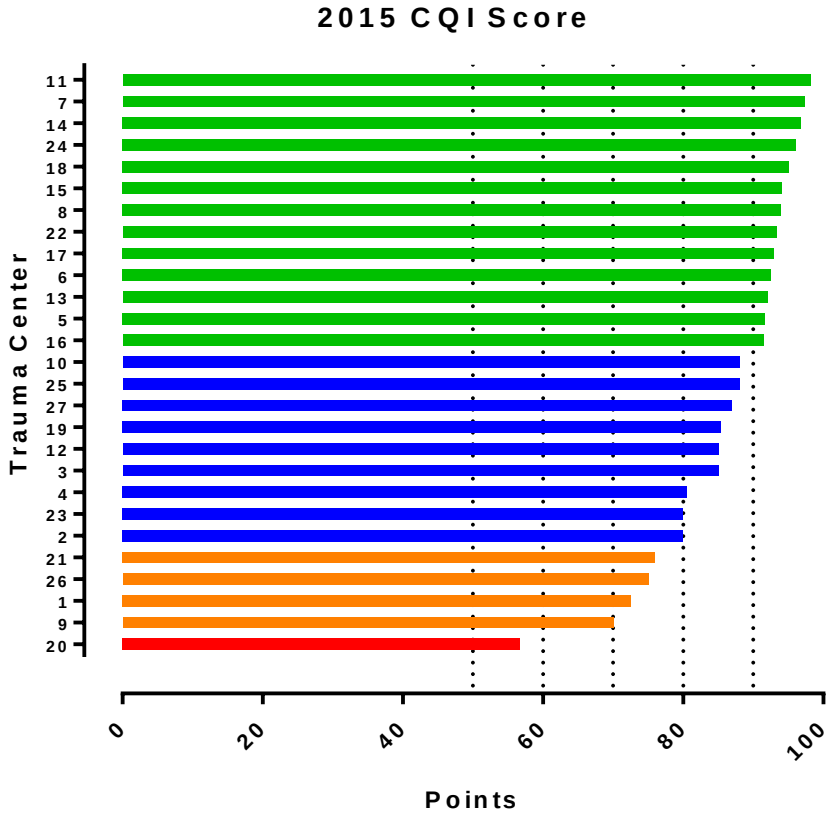

PRBC to Plasma Ratio
Trauma Center
18
12
5
22
11
10
17
7
27
14
20
16
24
21
4
19
3
23
9
15
13
8
6
1
2
25
26
0
5
10
Points


Timely VTE Prophylaxis
Trauma Center
8
3
9
5
1
12
11
23
18
10
13
2
26
24
16
20
22
14
6
15
21
7
17
25
19
27
4
0
5
10
Points


2015 CQI Score
Trauma Center
11
7
14
24
18
15
8
22
17
6
13
5
16
10
25
27
19
12
3
4
23
2
21
26
1
9
20
0
20
40
60
80
100
Points



Mean 85.3



Mean 86.4

It's not perfect – What we have learned

- Attention grabber
- Getting points is achievable by all
- Data
  - Scoring due 1st Quarter
  - Last data submission in Oct
  - Use data from Jan 2014 through Sept 2015
- ~~Reactionary~~ / Thoughtful
- Perceptions vs. Reality e.g. Blood
  - 2014: 145 points over 26 centers = 5.58 mean
  - 2015: 149.7 points over 27 centers = 5.54 mean

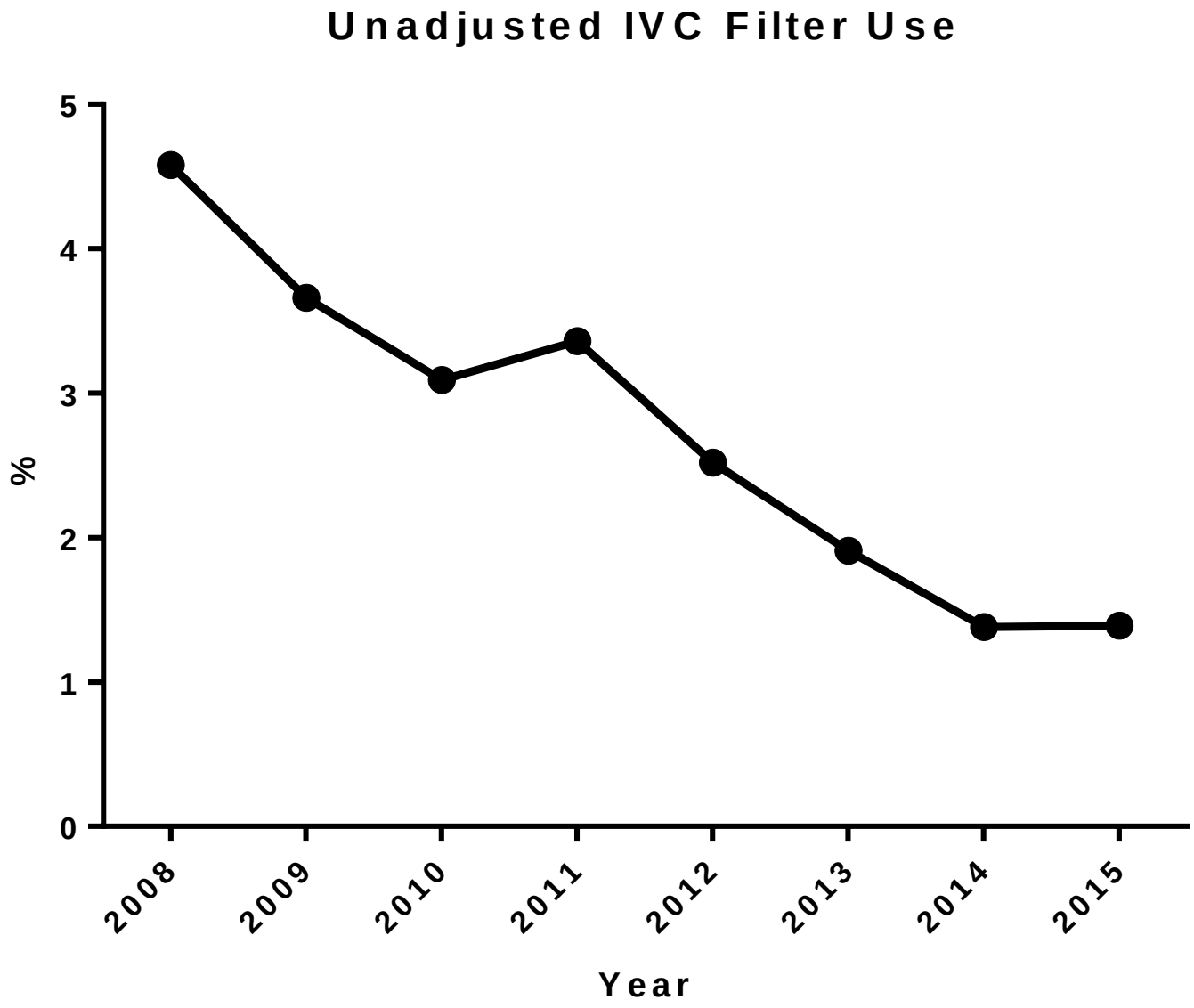
MTQIP Data/Reports

Jill Jakubus, PA-C, MHSA
Mark Hemmila, MD

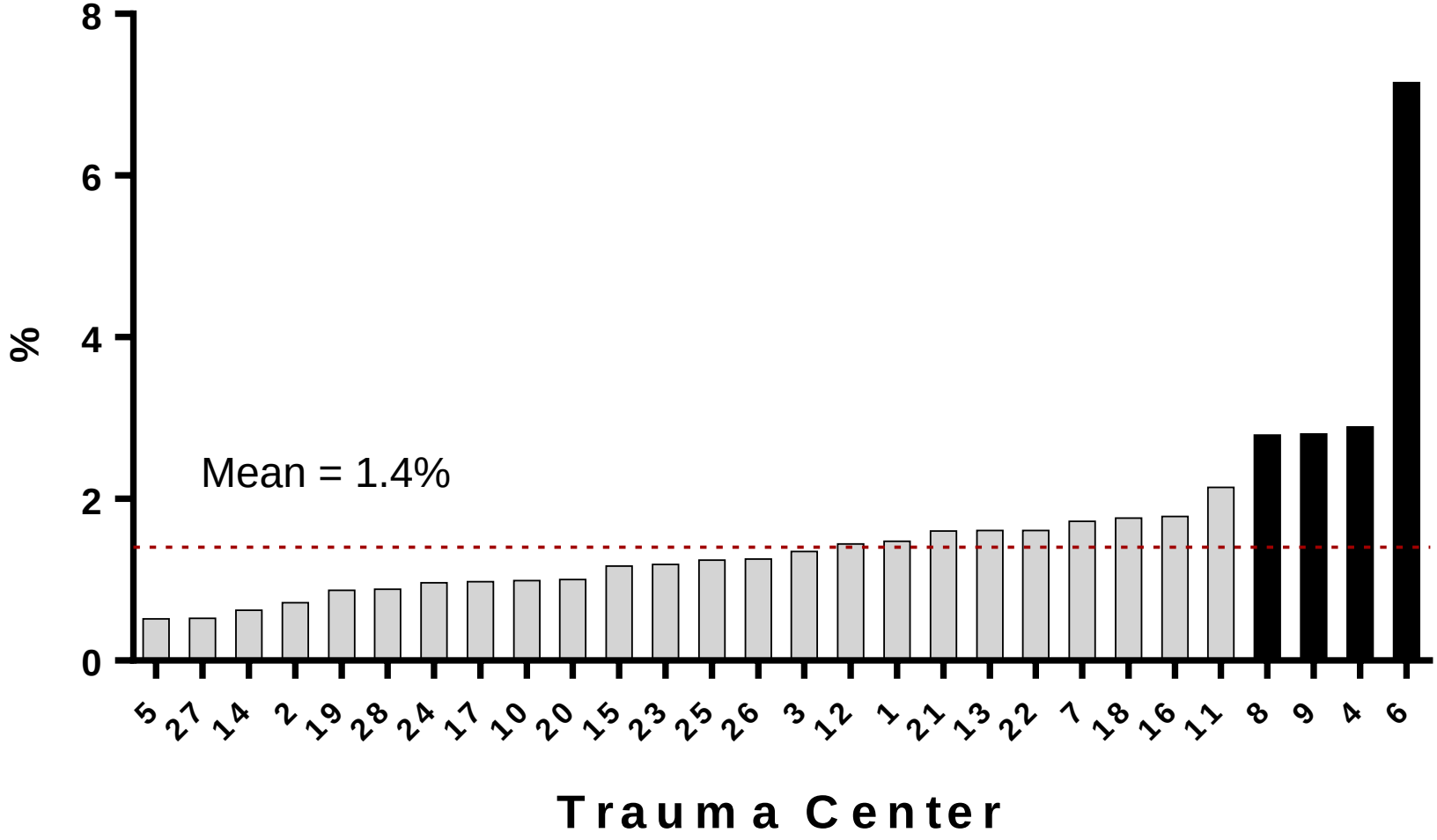
Collaborative-Wide Metric
IVC Filter Placement

2016 Group Project

- Target is 1.5% for 2016 reporting
- If collaborative mean is ≤ 1.5% every center gets 10 points.
- If collaborative mean is > 1.5% every center gets 0 points.
- At or near target – maintain performance
- Above target
  - Educate providers
  - Assistance from collaborative members

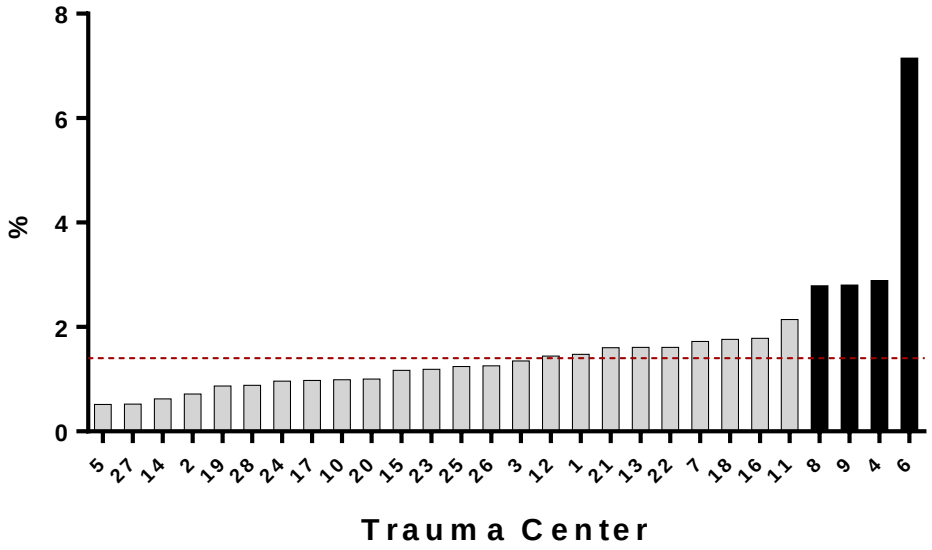

Unadjusted IVC Filter Use
5
4
3
2
1
0
%
2008
2009
2010
2011
2012
2013
2014
2015
Year

Risk and Reliability Adjusted IVC Filter Use



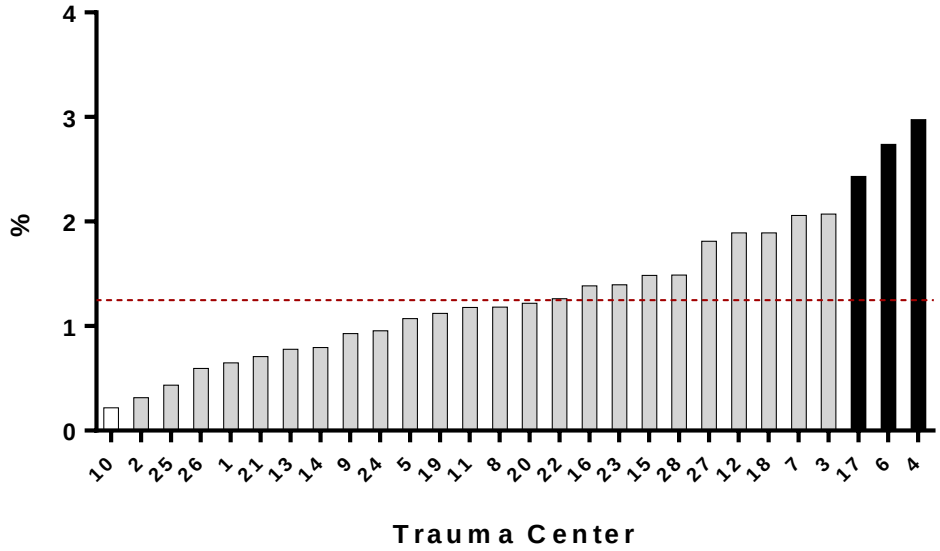
3/1/14 – 9/30/15

Risk and Reliability Adjusted IVC Filter Use

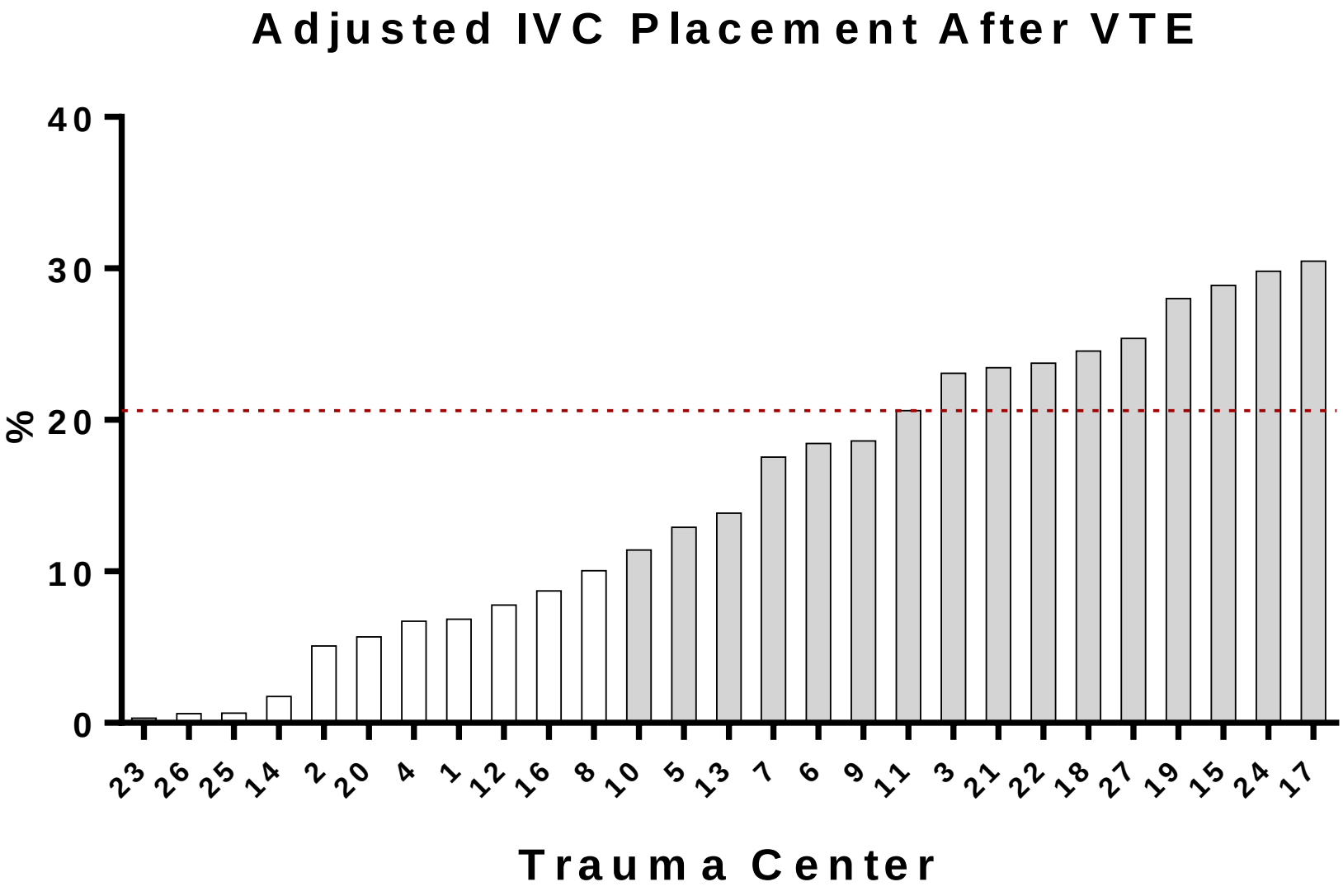


Pg. 32

DVT/Pulmonary Embolus



Pg. 32


Adjusted IVC Placement After VTE
40
30
20
10
0
%
23 26 25 14 2 20 4 1 12 16 8 10 5 13 7 6 9 11 3 21 22 18 27 19 15 24 17
Trauma Center

Hospital Metrics

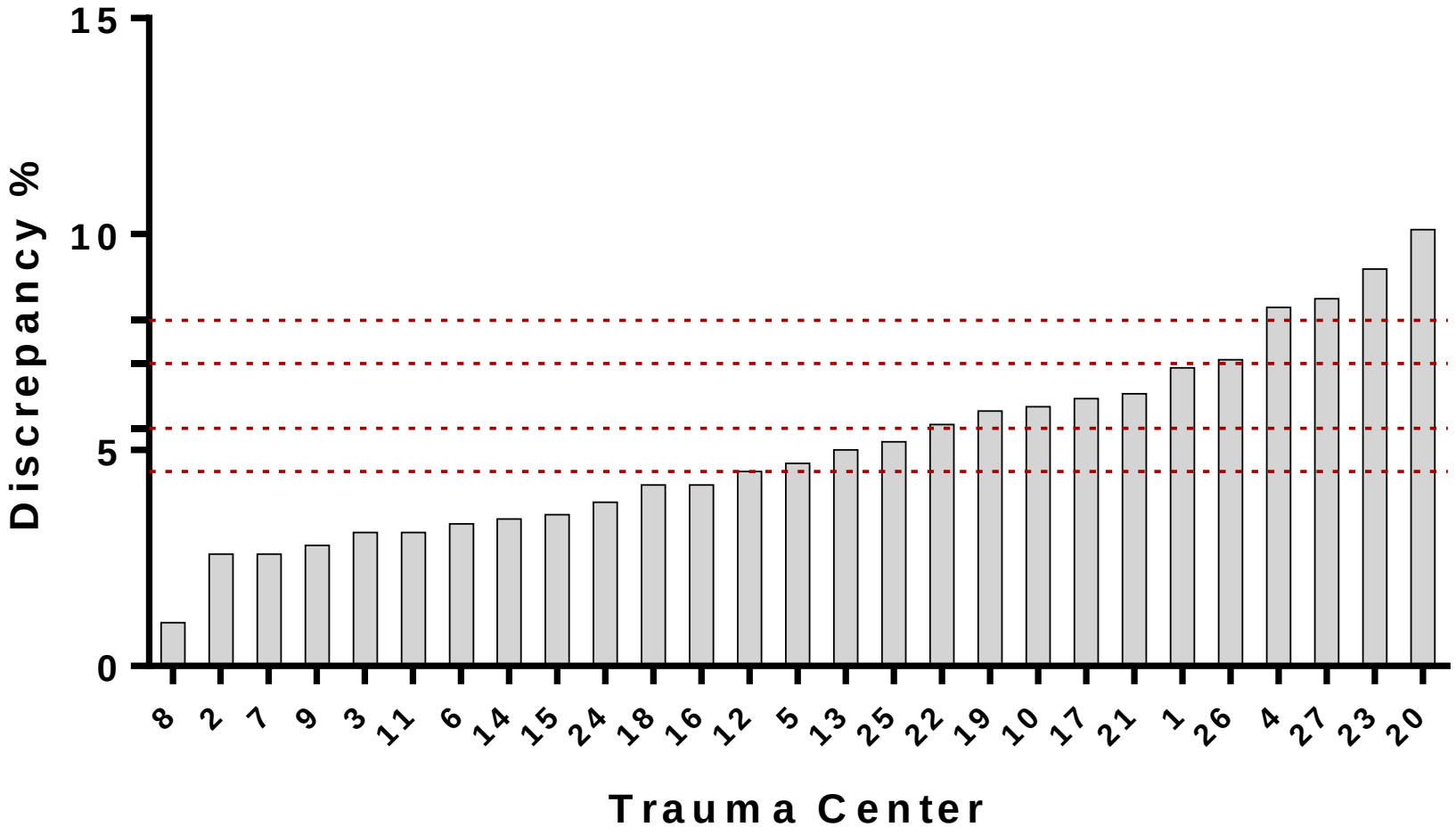
MTQIP 2015 Hospital Metrics

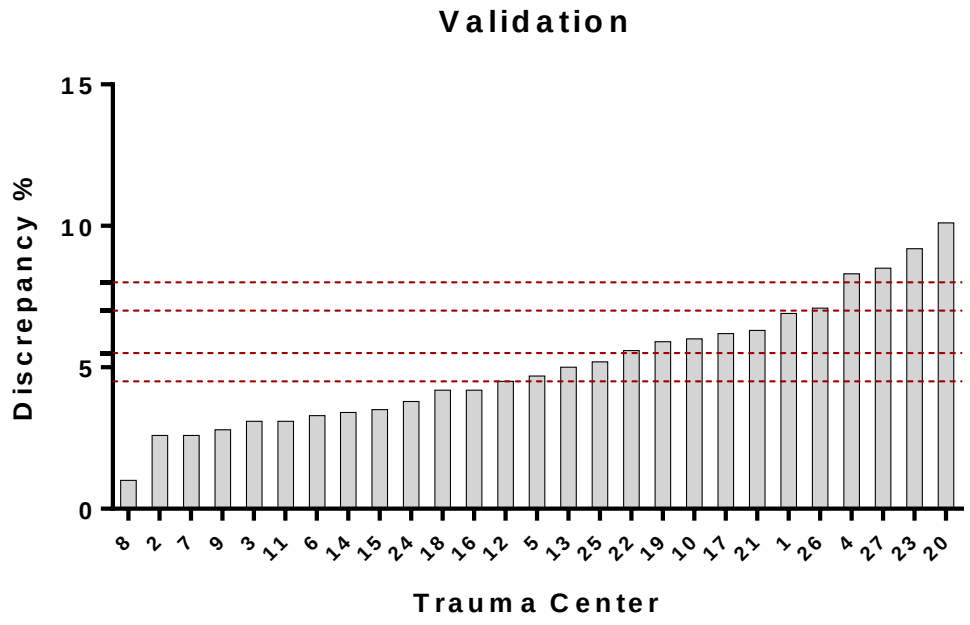
- Participation 60%
  - Data Submission
  - Surgeon Lead
  - Trauma Program Manager/Registrar
  - Presentation/Use of MTQIP data
- Performance 40%
  - Data Validation
  - Site-specific QI project
  - Massive Transfusion Protocol
  - VTE Prophylaxis

Performance

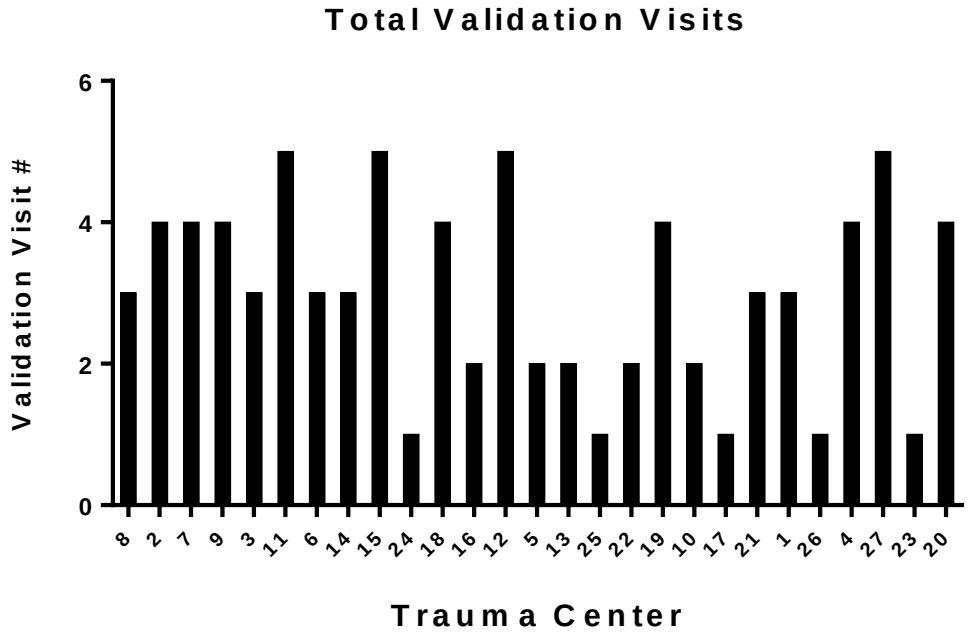
#5	10	**Data Accuracy**	**First Validation Visit Error Rate**	**Two or > Validation Visits Error Rate**		PERFORMANCE (40%)
		5 Star Validation	0-4.5%	0-4.5%	10	
		4 Star Validation	4.6-5.5%	4.6-5.5%	8	
		3 Star Validation	5.6-8.0%	5.6-7.0%	5	
		2 Star Validation	8.1-9.0%	7.1-8.0%	3	
		1 Star Validation	>9.0%	>8.0%	0	
#6	10	**Site Specific Quality Initiative Using MTQIP Data (Feb 2015-Feb 2016)**				
		Developed and implemented with evidence of improvement			10	
		Developed and implemented with no evidence of improvement			5	
		Not developed or implemented			0	
#7	10	**Mean Ratio of Packed Red Blood Cells (PRBC) To Fresh Frozen Plasma (FFP) In Patients Transfused ≥5 Units RBC In First 4 Hrs (18 Months Data)**				
		Tier 1: ≤ 1.5			10	
		Tier 2: 1.6-2.0			10	
		Tier 3: 2.1-2.5			5	
		Tier 4: >2.5			0	
#8	10	**Admitted Patients (Trauma Service-Cohort 2) With Initiation Of Venous Thromboembolism (VTE) Prophylaxis <48 Hours After Arrival (18 Months Data)**				
		>50%			10	
		≥40%			5	
		<40%			0	
				Total (Max Points) =	100	

Validation

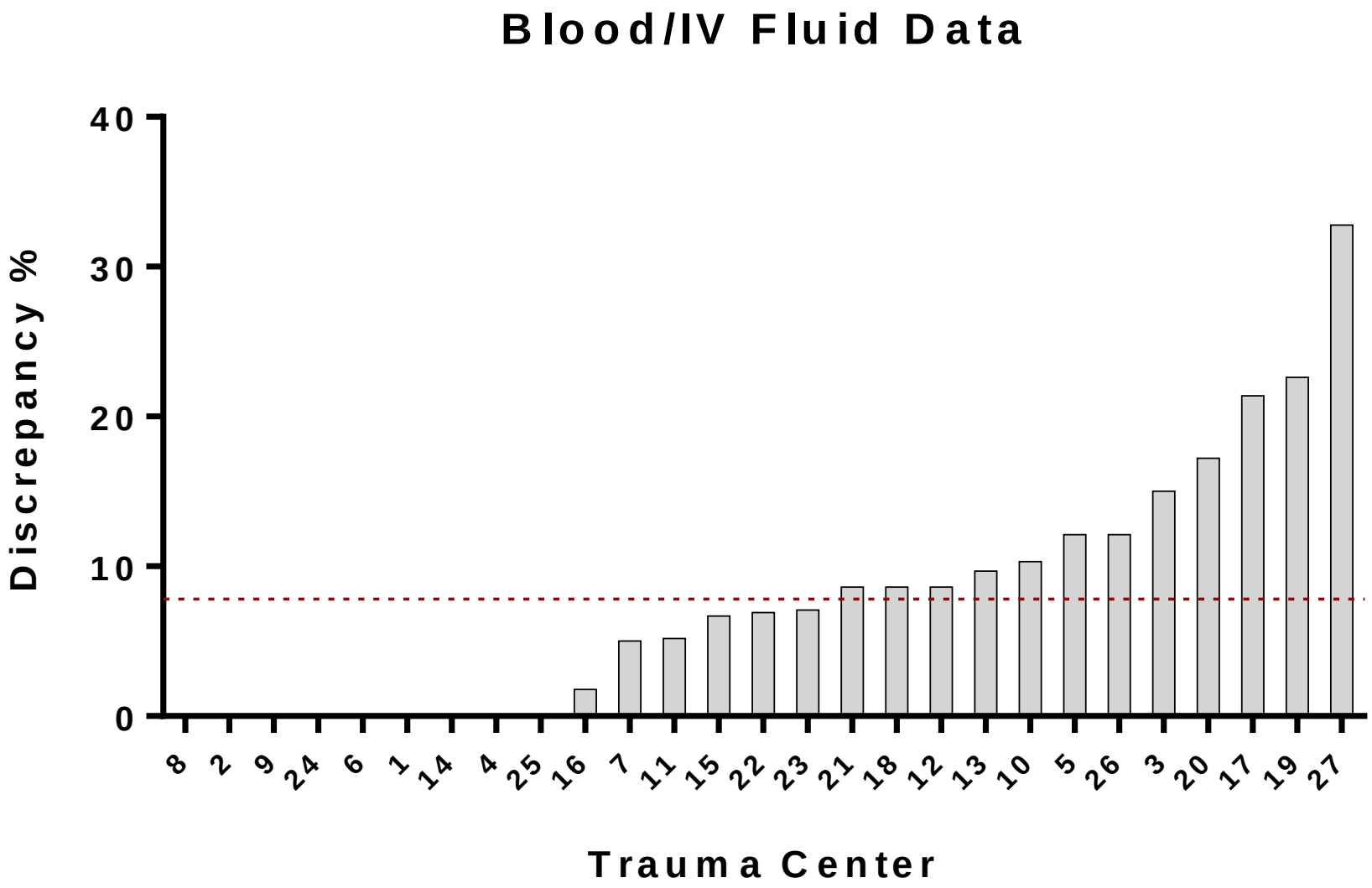

15
10
5
0
Discrepancy %
8 2 7 9 3 11 6 14 15 24 18 16 12 5 13 25 22 19 10 17 21 1 26 4 27 23 20
Trauma Center


Validation
Discrepancy %
15
10
5
0
8 2 7 9 3 11 6 14 15 24 18 16 12 5 13 25 22 19 10 17 21 1 26 4 27 23 20
Trauma Center

Pg. 38


Total Validation Visits
Validation Visit #
6
4
2
0
8 2 7 9 3 11 6 14 15 24 18 16 12 5 13 25 22 19 10 17 21 1 26 4 27 23 20
Trauma Center

Pg. 38


Blood/IV Fluid Data
Discrepancy %
40
30
20
10
0
8 2 9 24 6 1 14 4 25 16 7 11 15 22 23 21 18 12 13 10 5 26 3 20 17 19 27
Trauma Center

Massive Transfusion Ratio

- Massive Transfusion
  - ≥ 5 units PRBC's in first 4 hrs
  - Average of tier points score for each patient
  - 0 units FFP places patient in tier 4
  - 1/1/14 – 9/30/15

Ratio PRBC/FFP	Tier	Points
< 1.5	1	10
1.6 – 2.0	2	10
2.1 – 2.5	3	5
> 2.5	4	0

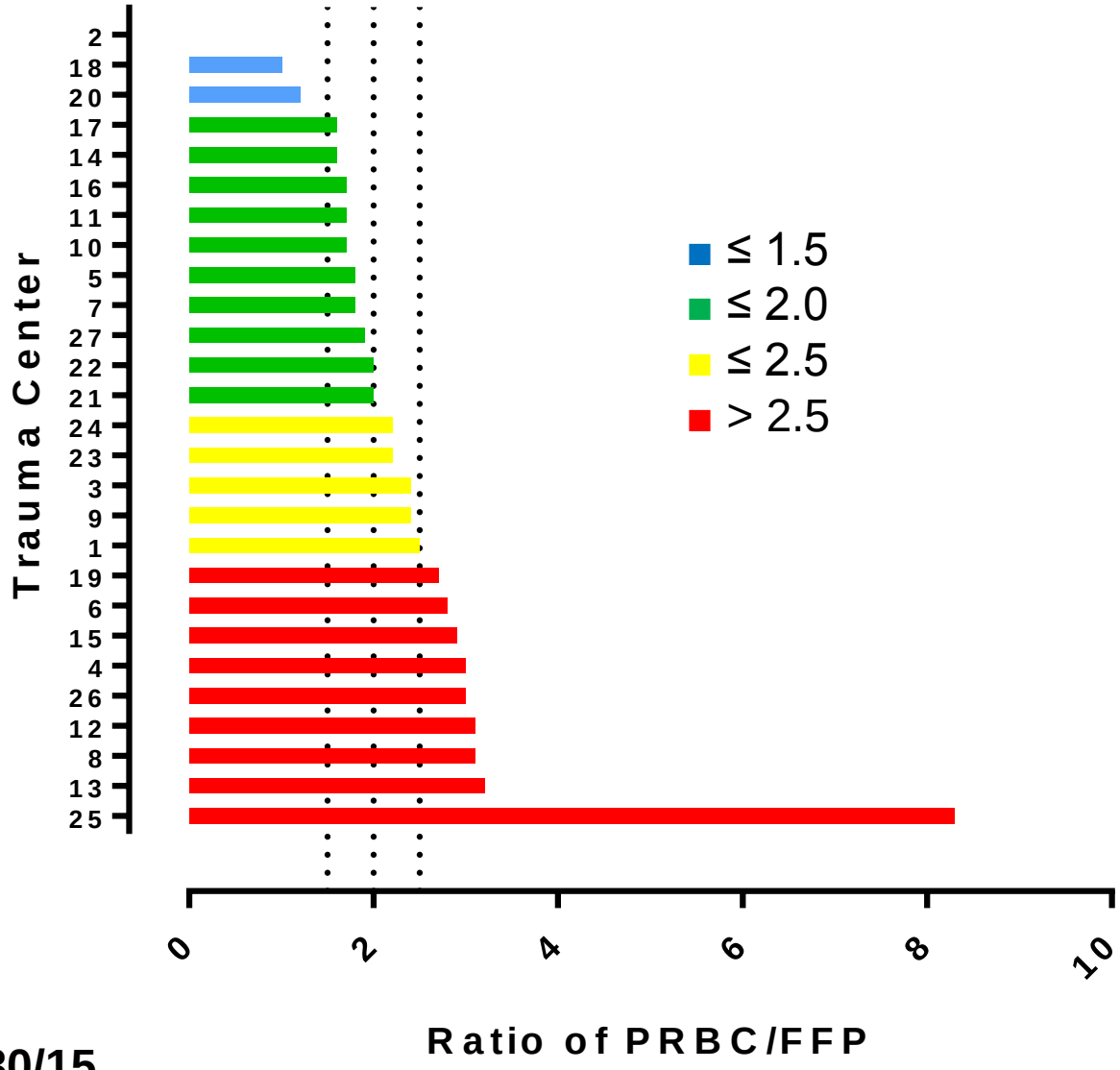
Massive Transfusion Metric Calculation Example

Patient	PRBC	FFP	PRBC/FFP	Tier	Points
1	10	10	1.0	1	10
2	5	4	1.3	1	10
3	7	4	1.8	2	10
4	8	5	1.6	2	10
5	5	2	2.5	3	5
6	7	3	2.3	3	5
7	9	2	4.5	4	0
8	5	1	5.0	4	0
9	11	0		4	0
10	6	0		4	0
					50

$$\frac{\text{Total Points}}{\text{Total Patients}} = \text{Metric Points}$$

$$\frac{50}{10} = 5$$

Blood Product Ratio in first 4 hrs if ≥ 5 uPRBCs

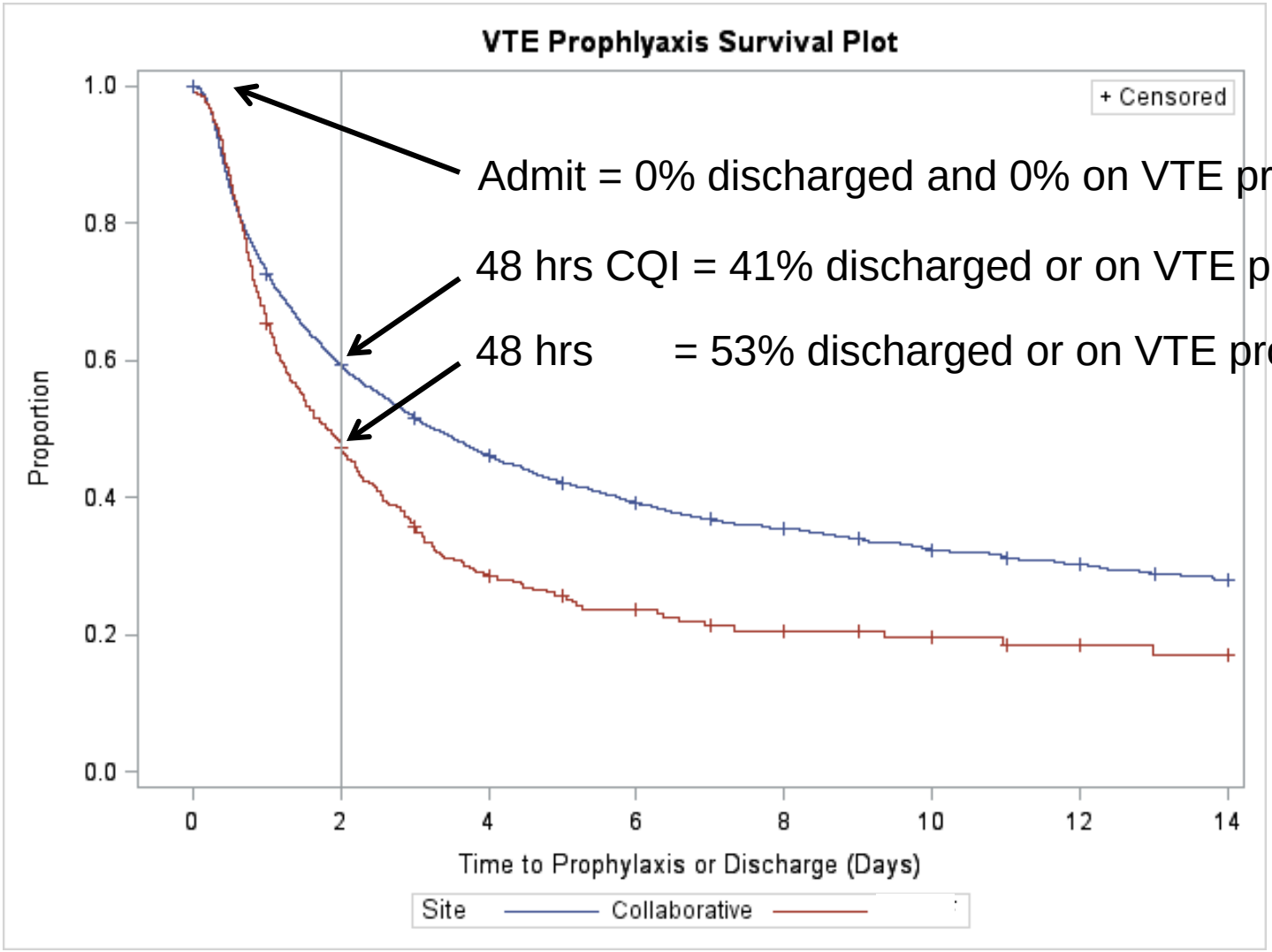


1/1/14 – 9/30/15

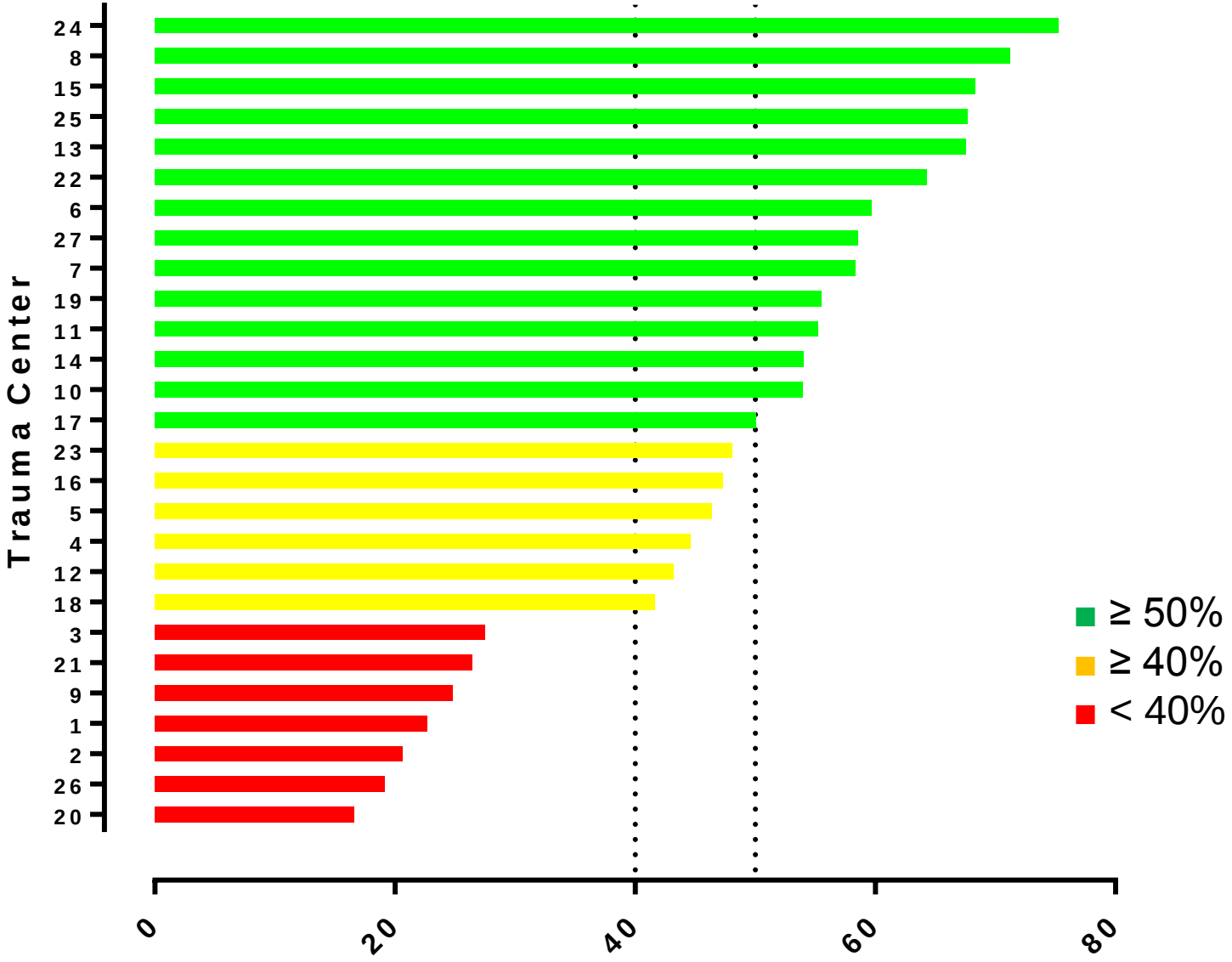
VTE Prophylaxis

- Admit Trauma Service
  - In hospital with no VTE pro = non-Event
  - Discharge Home in 48 hrs = Event
  - VTE Prophylaxis in 48 hrs = Event
  - 1/1/14 – 6/30/15
- Rate
  - ≥ 50% (10 points)
  - ≥ 40% (5 points)
  - 0 – 39% (0 points)

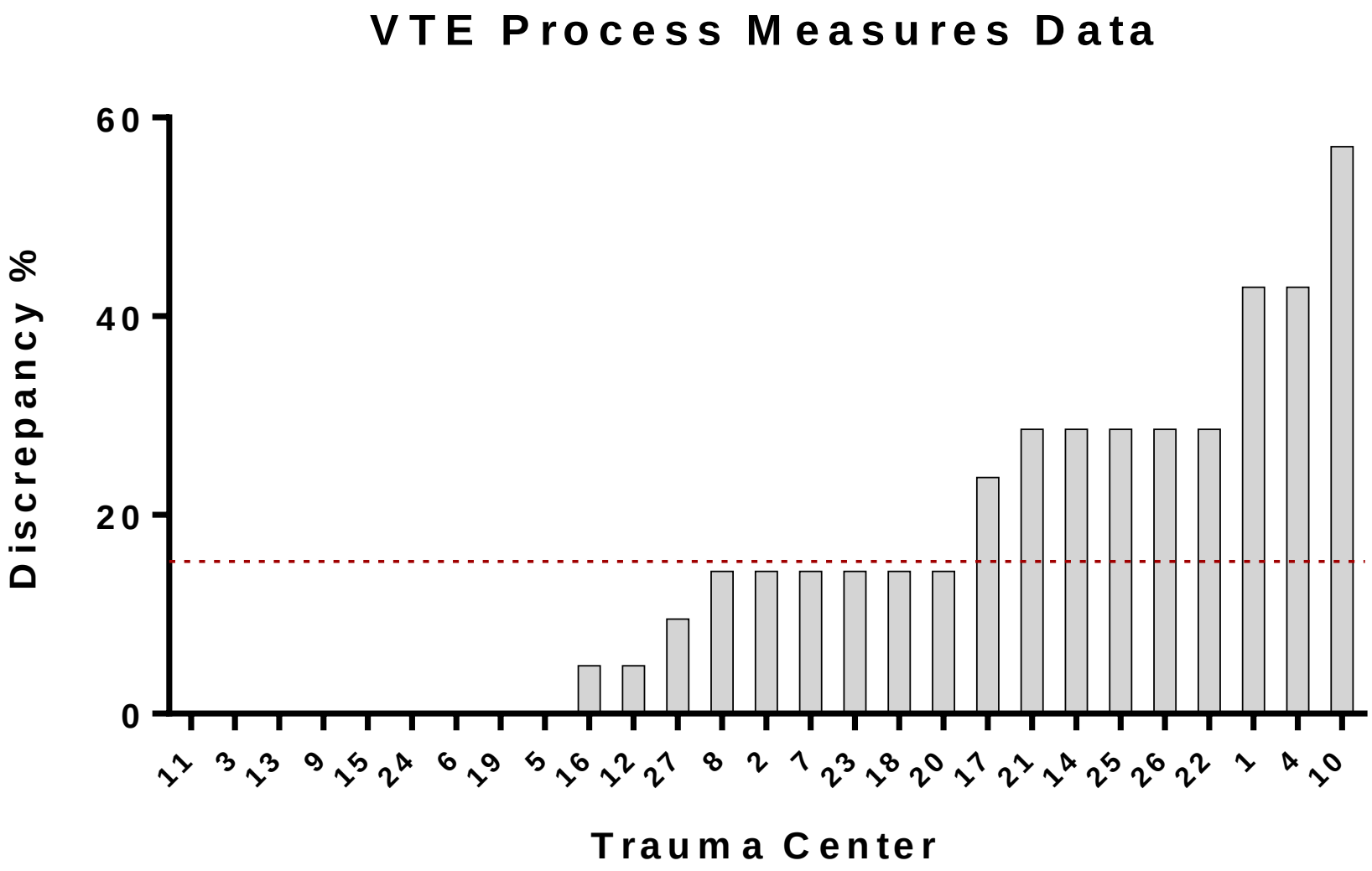
VTE Prophylaxis Kaplan-Meier



Rate of VTE Prophylaxis by 48 hrs



1/1/14-6/30/15


VTE Process Measures Data
Discrepancy %
60
40
20
0
11
3
13
9
15
24
6
19
5
16
12
27
8
2
7
23
18
20
17
21
14
25
26
22
1
4
10
Trauma Center

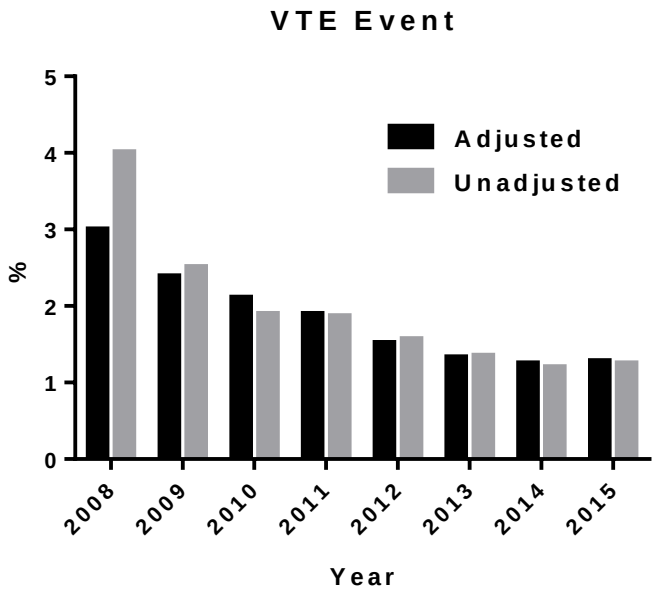
Collaborative-Wide PI Projects

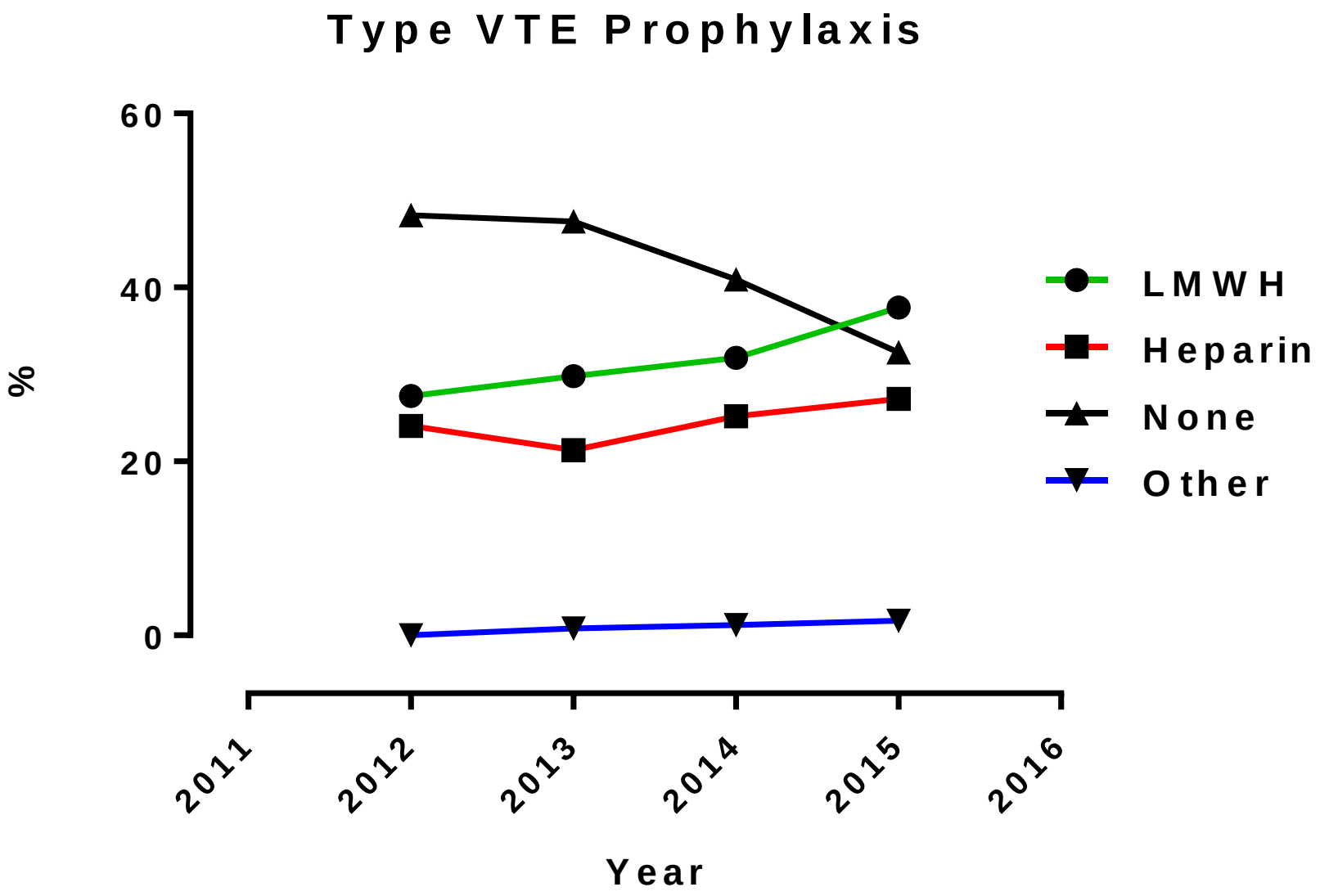
MTQIP 2015 Collaborative-Wide PI Projects

- Hemorrhage (≥ 5 u PRBC's first 4 hrs)
  - 1/1/14 to 9/30/15
  - % of patients with 4hr PRBC/FFP ratio ≤ 2.5
    - Begin = 34 %
    - Previous = 62 %
    - Current = **64 %** (197/306)
    - Target = 80 %

MTQIP 2015 Collaborative-Wide PI Projects

- VTE
  - VTE Rate
    - Begin = 2.5 %
    - Previous = 1.3 %
    - Current = **1.3 %**
    - Target = 1.5 %
  - 48 hr VTE Prophylaxis Rate
    - Begin = 38 %
    - Previous = 46 %
    - Current = **48 %**
    - Target = 50 %



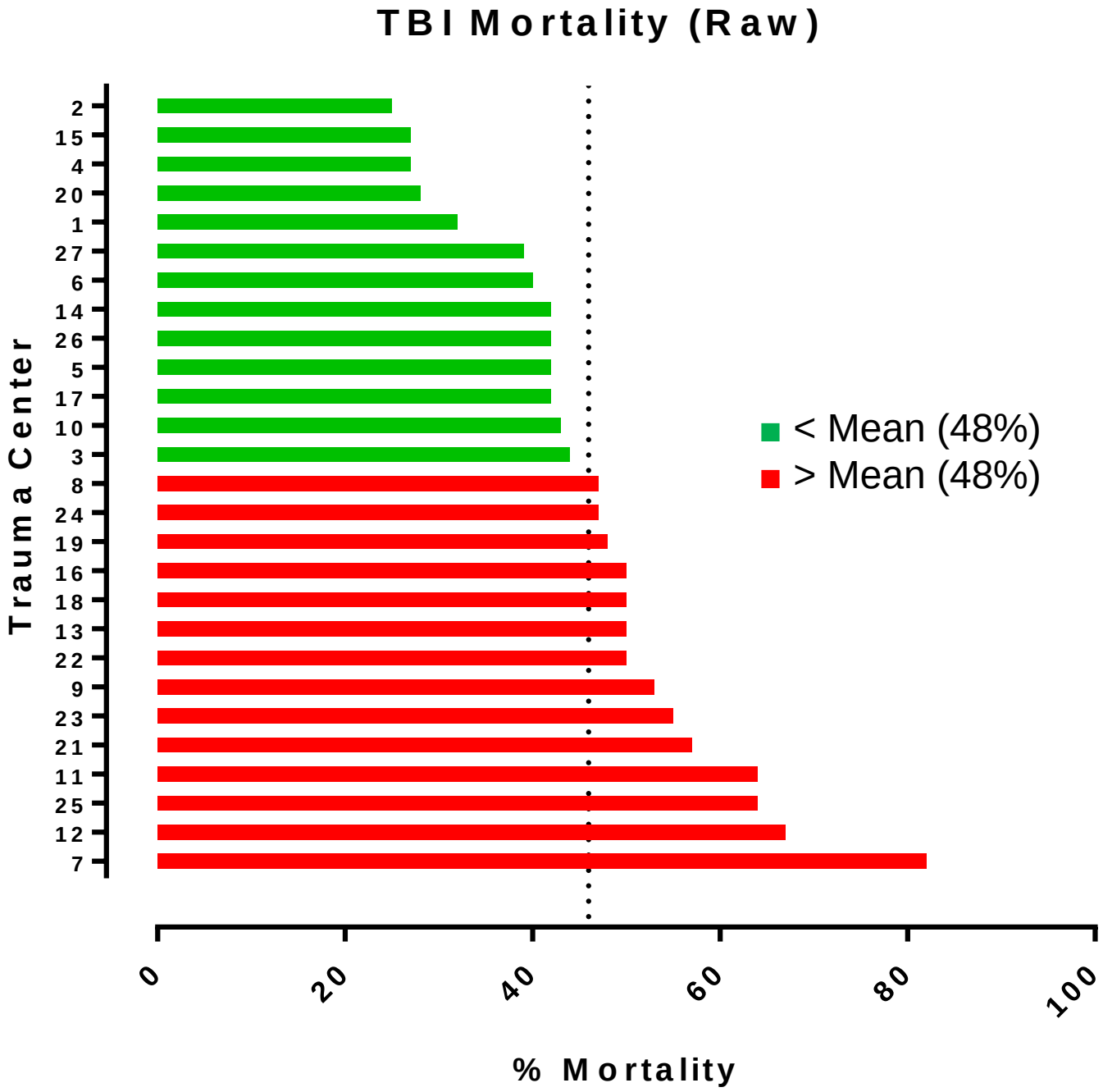

Type VTE Prophylaxis
60
40
20
0
%
2011
2012
2013
2014
2015
2016
Year
LMWH
Heparin
None
Other

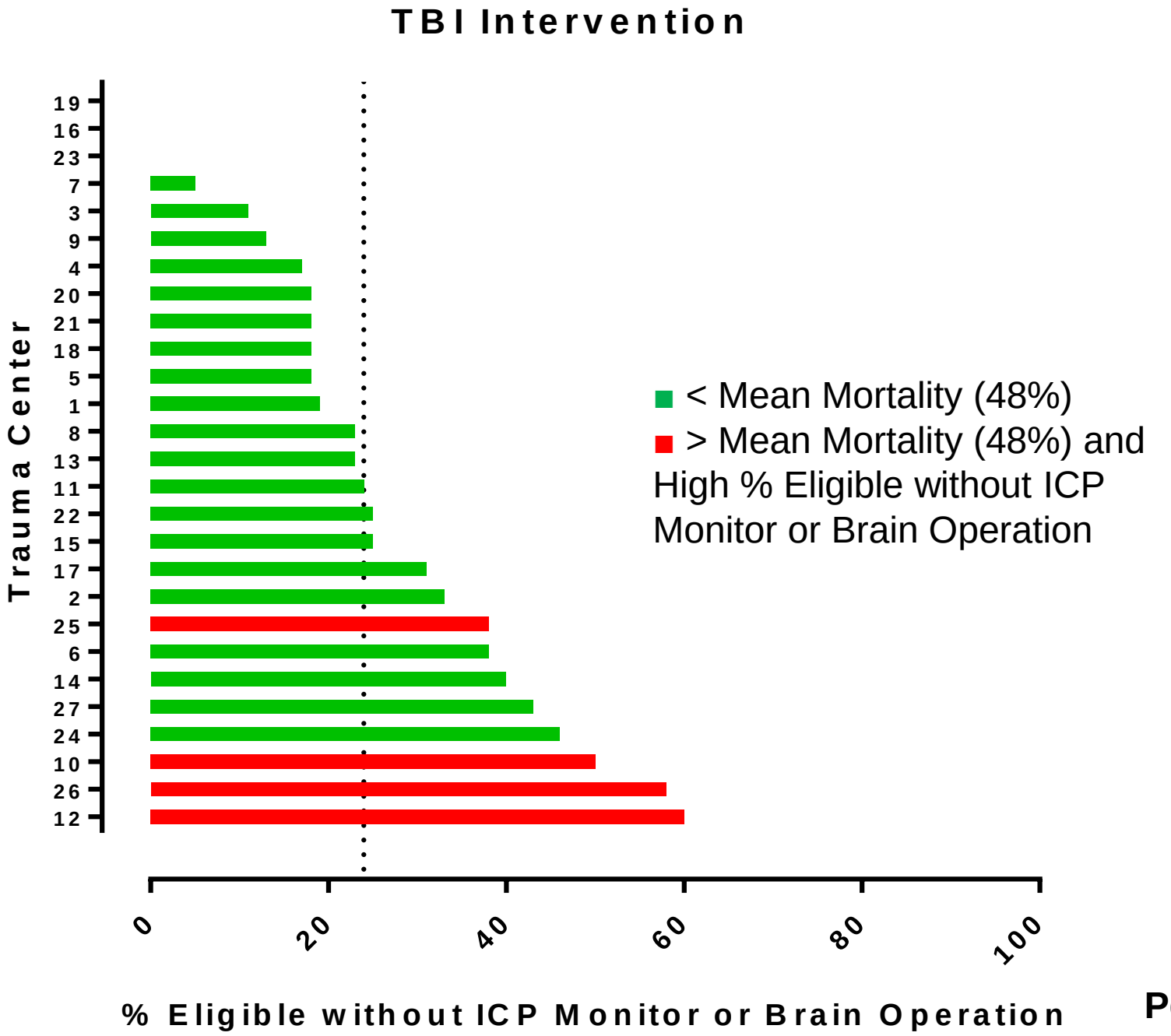
MTQIP 2015 Collaborative Metrics

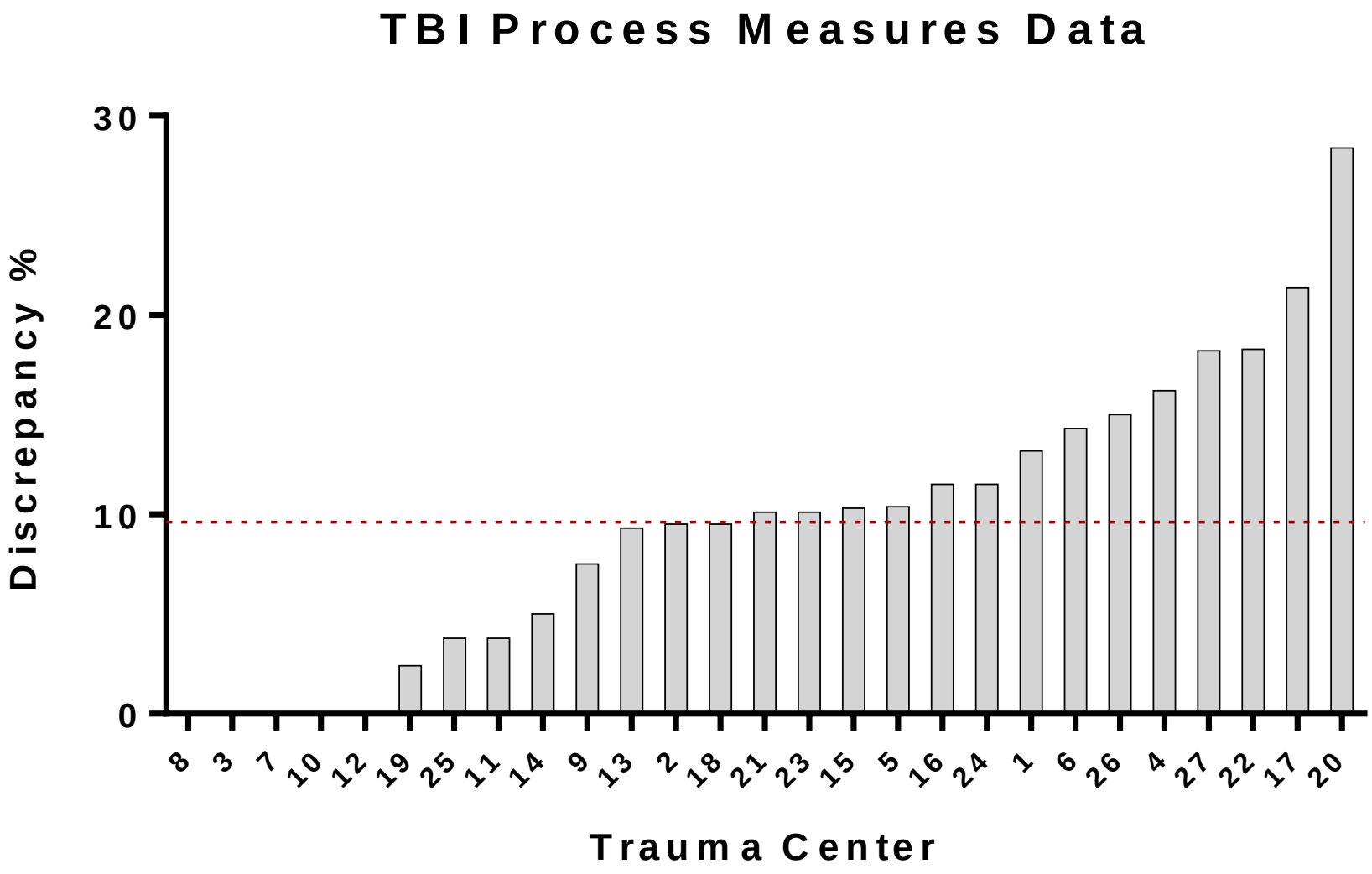
- Brain Injury
  - Selection Criteria
    - AIS Head > 0, excluding vascular, scalp, and bony injuries
    - Exclude if penetrating mechanism
    - Exclude if no signs of life
    - Exclude if direct admission transfer
    - Exclude if TBI GCS>8

MTQIP 2015 Collaborative Metrics

- Brain Injury
  - % of eligible patients with TBI intervention (Monitor or Operation)
    - Begin = 57 %
    - Previous = 74 %
    - Current = **76 %**
    - Target = 70 %

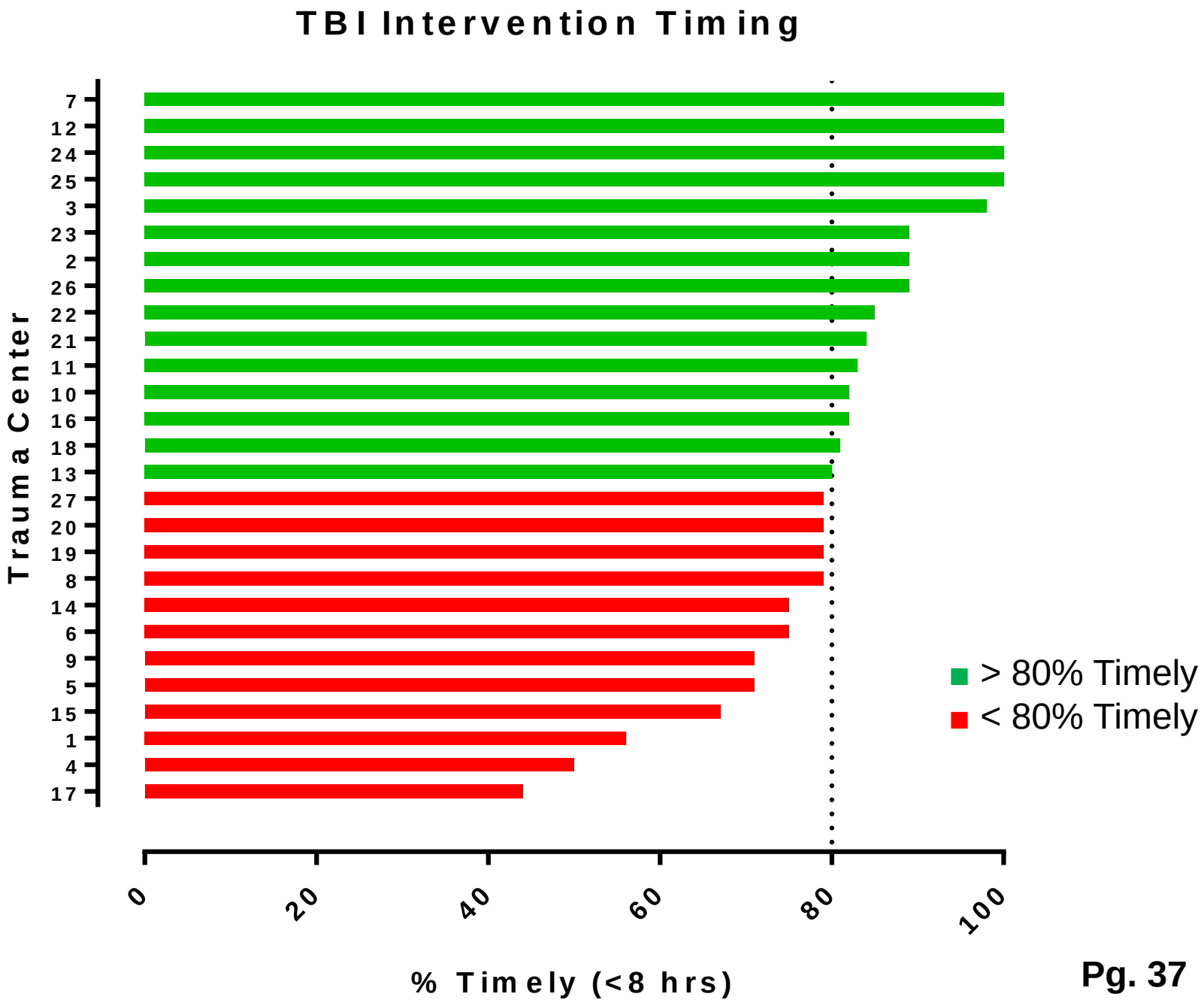

TBI Mortality (Raw)
Trauma Center
2
15
4
20
1
27
6
14
26
5
17
10
3
8
24
19
16
18
13
22
9
23
21
11
25
12
7
< Mean (48%)
> Mean (48%)
0
20
40
60
80
100
% Mortality


TBI Intervention
Trauma Center
19
16
23
7
3
9
4
20
21
18
5
1
8
13
11
22
15
17
2
25
6
14
27
24
10
26
12
< Mean Mortality (48%)
> Mean Mortality (48%) and High % Eligible without ICP Monitor or Brain Operation
0
20
40
60
80
100
% Eligible without ICP Monitor or Brain Operation


TBI Process Measures Data
Discrepancy %
30
20
10
0
8 3 7 10 12 19 25 11 14 9 13 2 18 21 23 15 5 16 24 1 6 26 4 27 22 17 20
Trauma Center

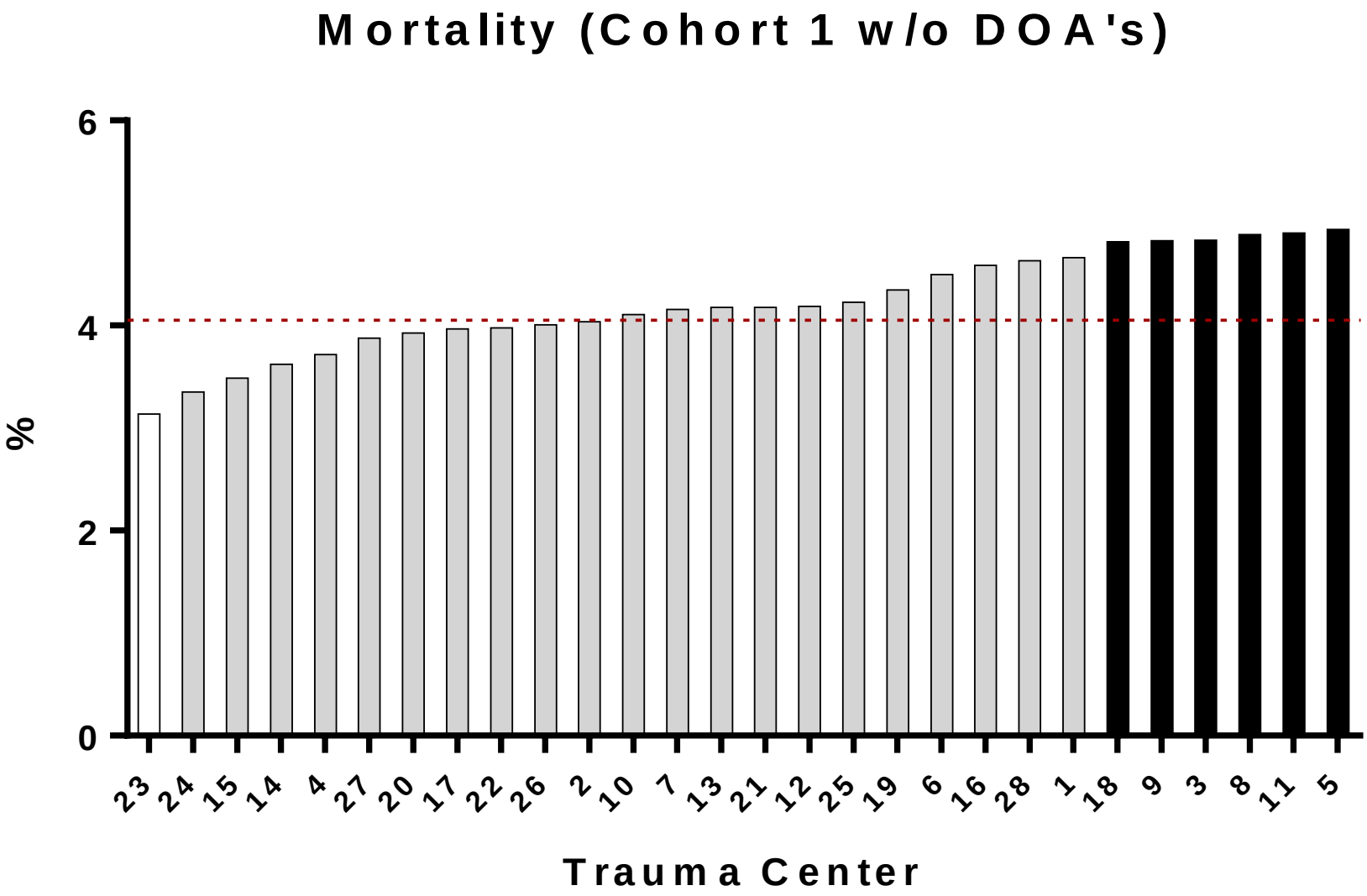
MTQIP 2015 Collaborative-Wide PI Projects

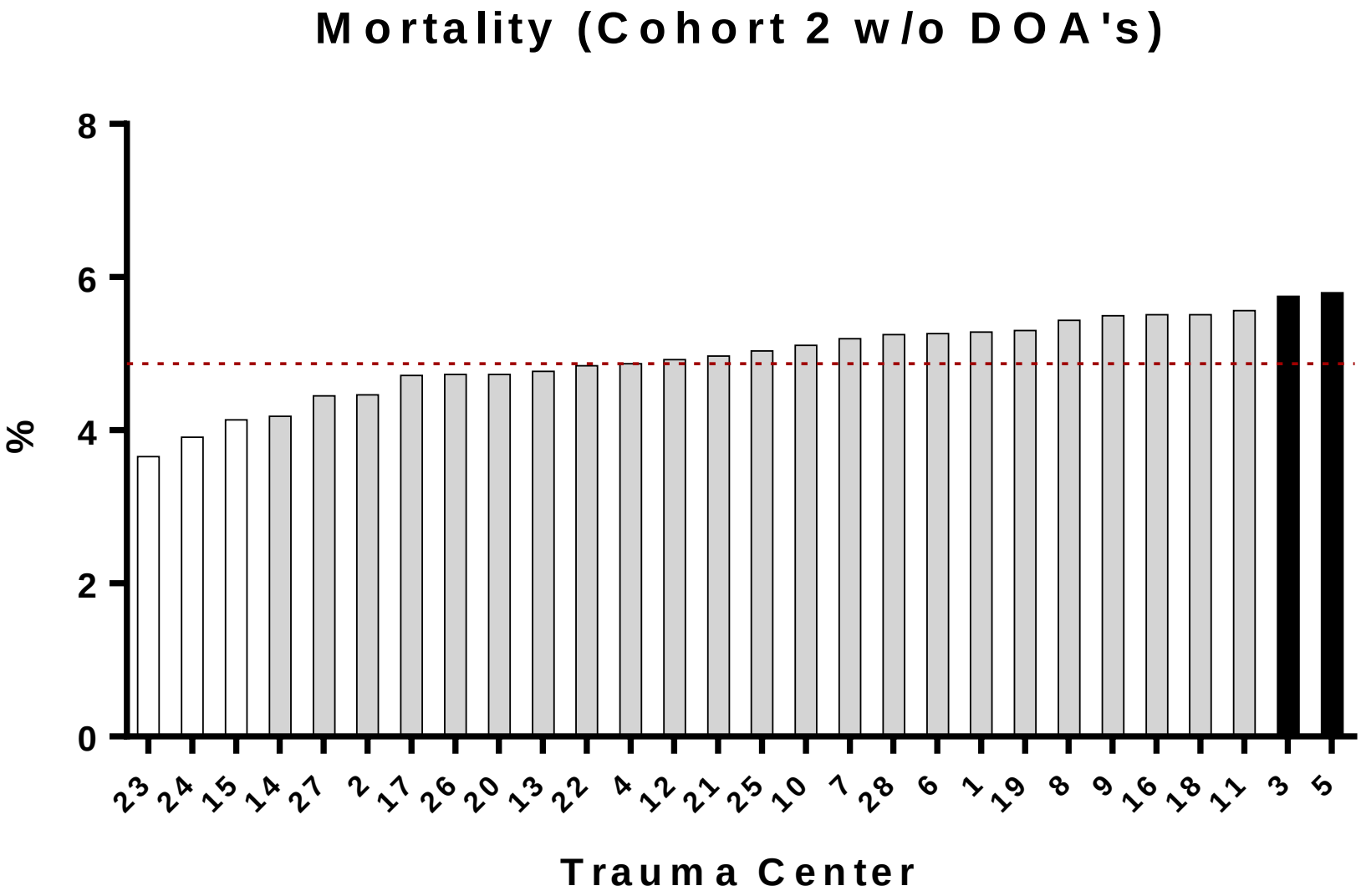
- Brain Injury
  - % of TBI intervention patients with timely intervention (≤ 8 hrs after arrival)
    - Begin = 65 %
    - Previous = 81 %
    - Current = **78 %**
    - Target = 80 %

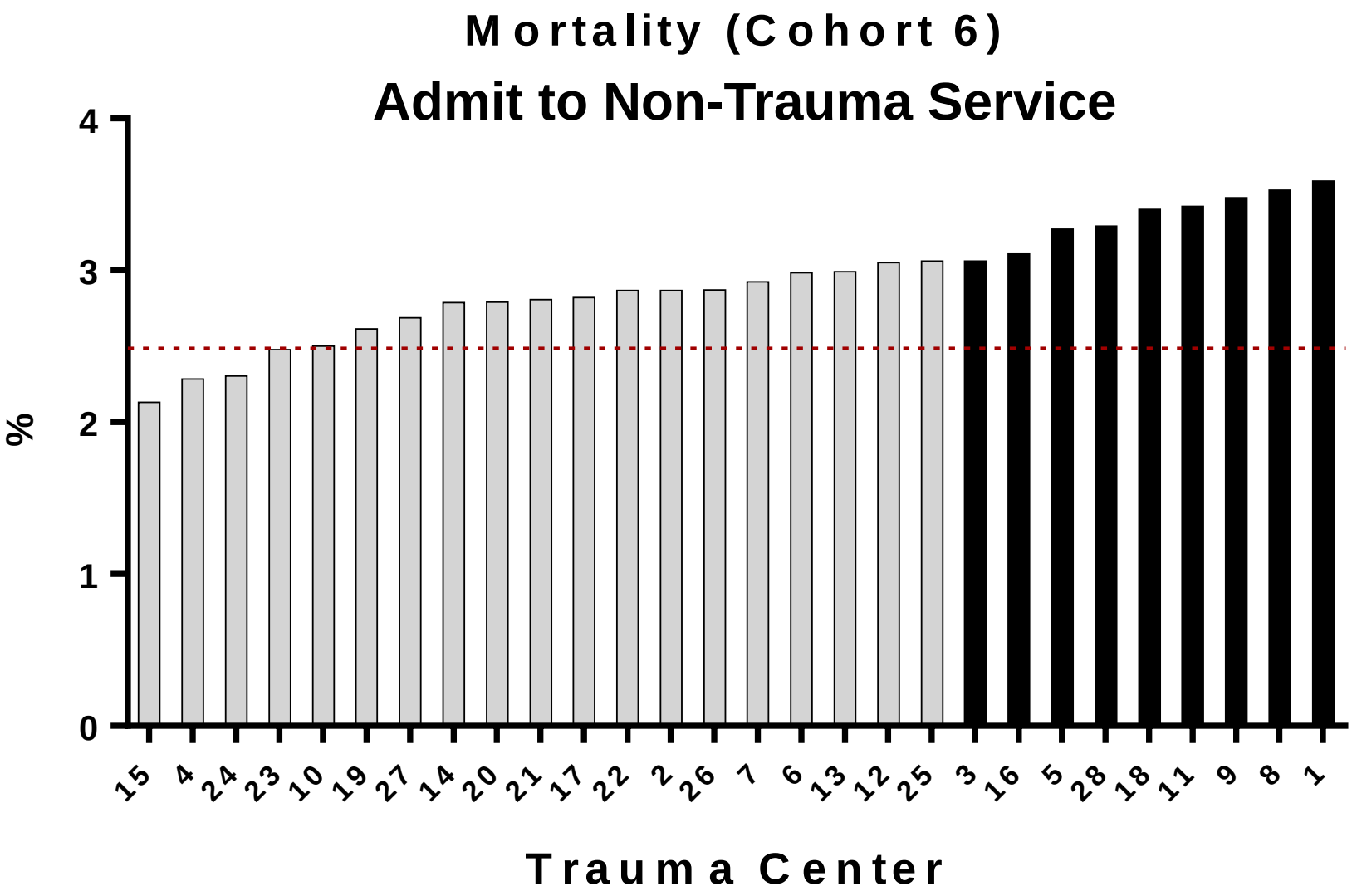

TBI Intervention Timing
Trauma Center
7
12
24
25
3
23
2
26
22
21
11
10
16
18
13
27
20
19
8
14
6
9
5
15
1
4
17
0
20
40
60
80
100
% Timely (<8 hrs)
> 80% Timely
< 80% Timely

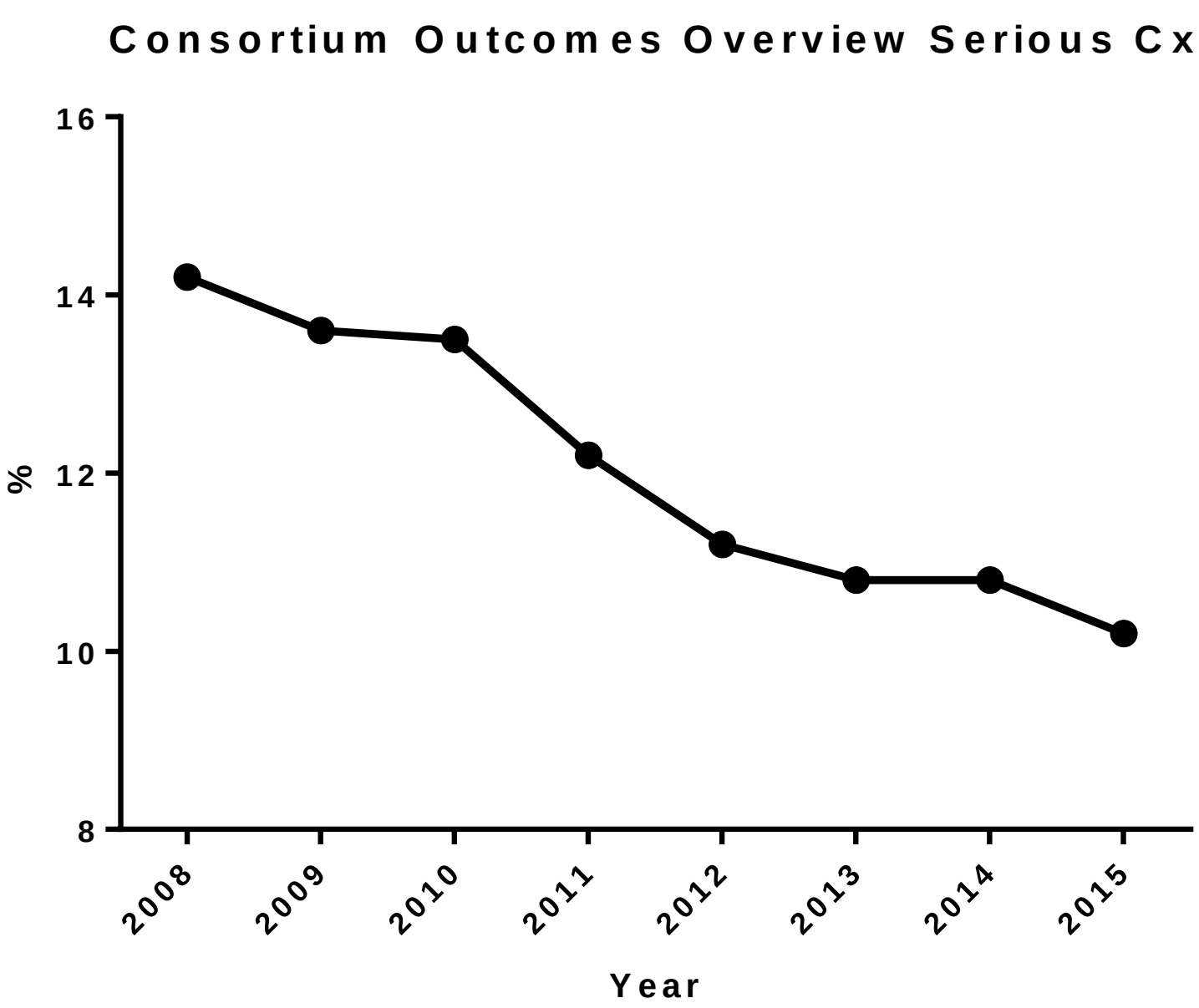
MTQIP Outcomes

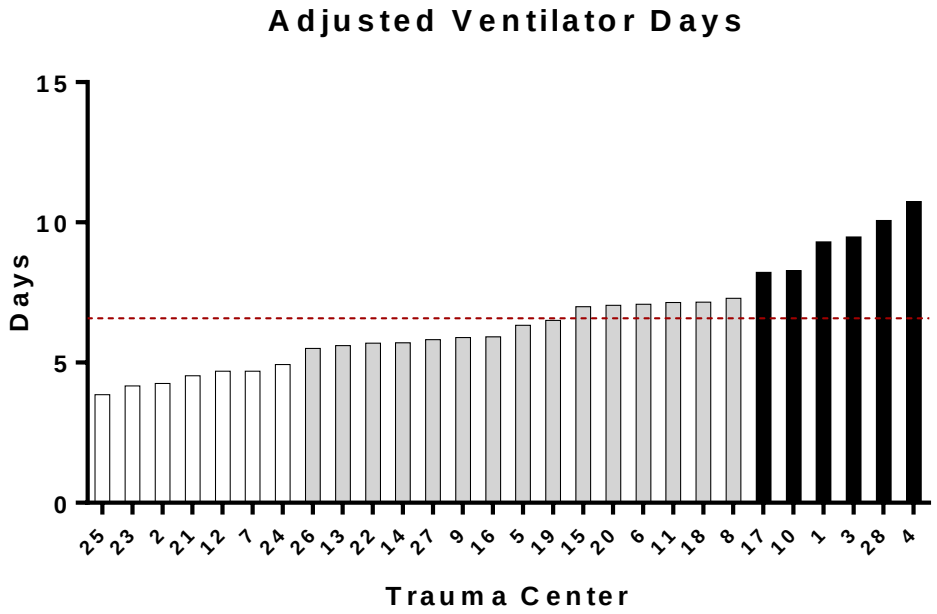
- ArborMetrix Report
  - 3/1/2014 to 9/30/2015 (Standard)
- Rates
  - Risk and Reliability-adjusted
  - Red dash line is collaborative mean
- Legend
  - □ Low-outlier status (better performance)
  - ▒ Non-outlier status (average performance)
  - ■ High-outlier status (worse performance)


Mortality (Cohort 1 w/o DOA's)
6
4
2
0
%
23 24 15 14 4 27 20 17 22 26 2 10 7 13 21 12 25 19 6 16 28 1 18 9 3 8 11 5
Trauma Center

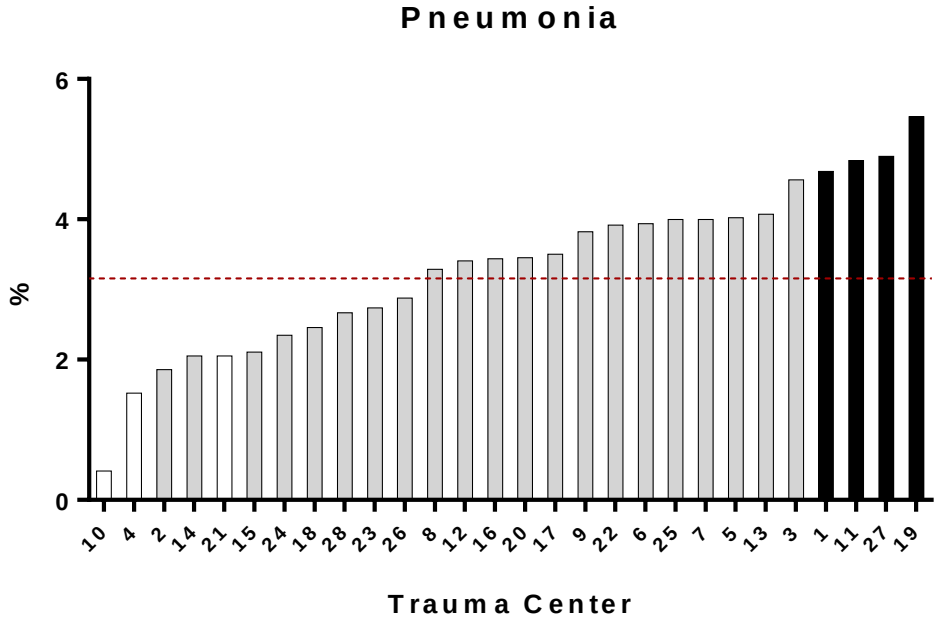

Mortality (Cohort 2 w/o DOA's)
8
6
4
2
0
%
23 24 15 14 27 2 17 26 20 13 22 4 12 21 25 10 7 28 6 1 19 8 9 16 18 11 3 5
Trauma Center


Mortality (Cohort 6)
Admit to Non-Trauma Service
%
4
3
2
1
0
15 4 24 23 10 19 27 14 20 21 17 22 2 26 7 6 13 12 25 3 16 5 28 18 11 9 8 1
Trauma Center

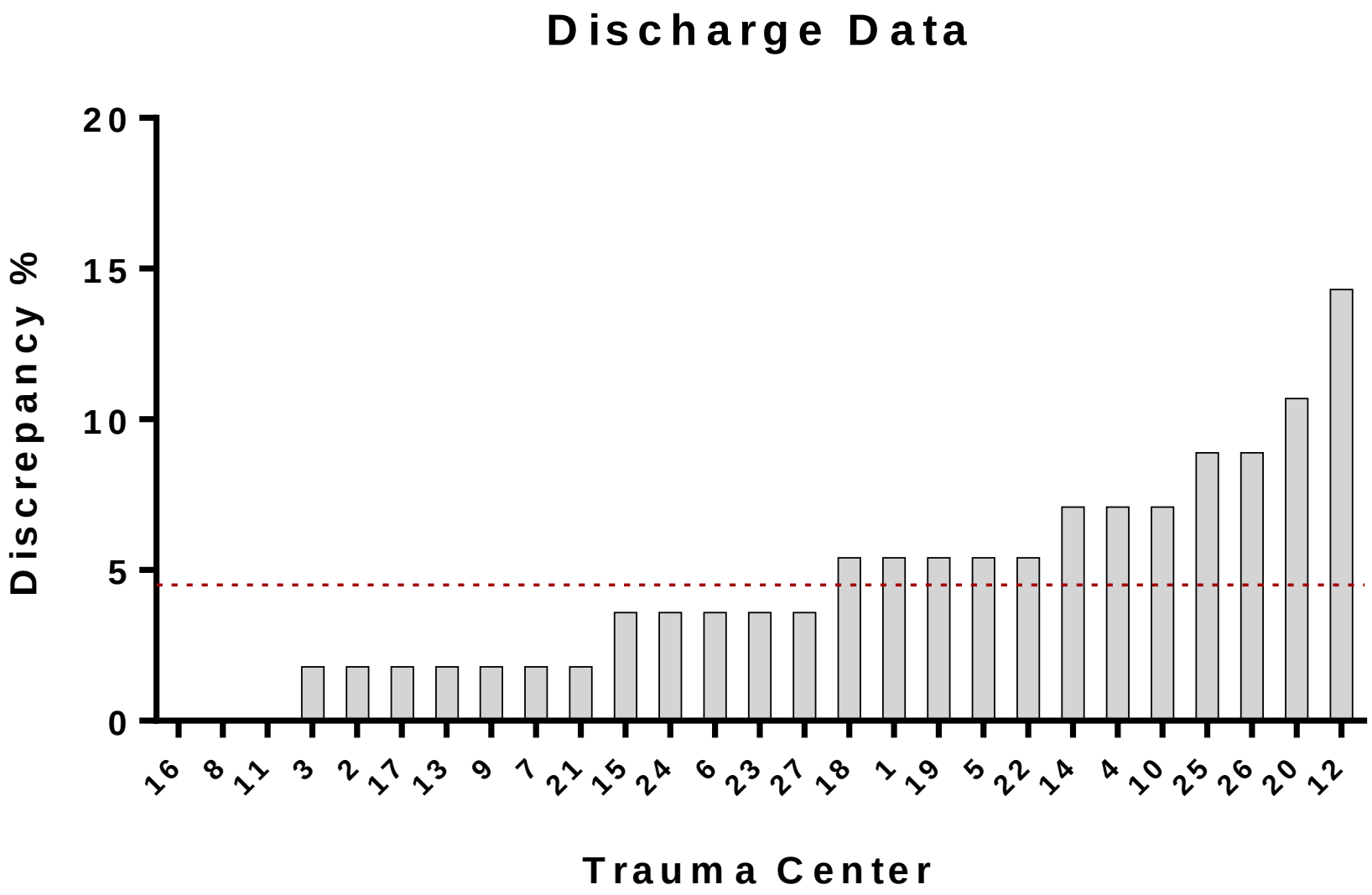

Consortium Outcomes Overview Serious Cx
16
14
12
10
8
%
2008
2009
2010
2011
2012
2013
2014
2015
Year

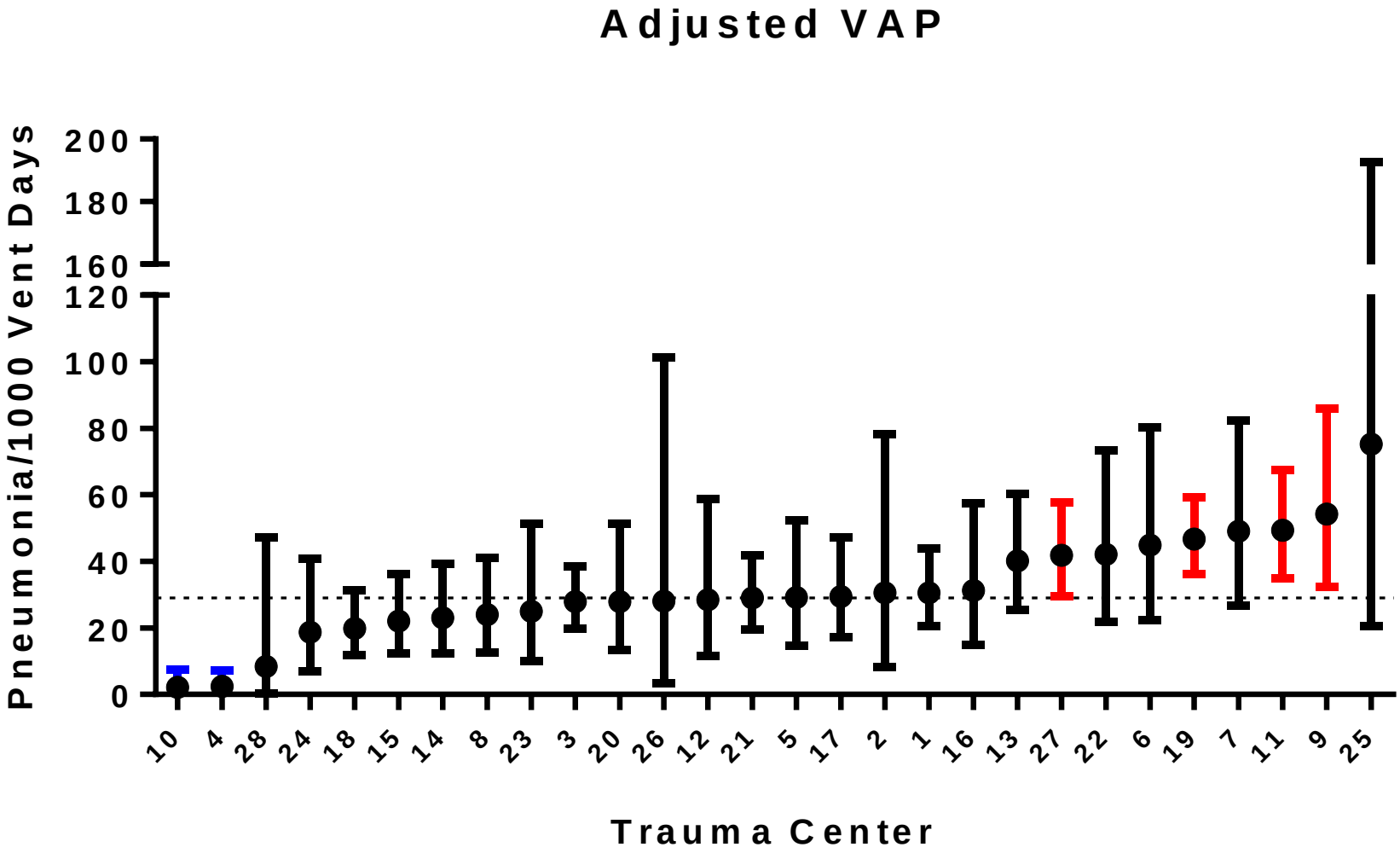

Adjusted Ventilator Days
Days
15
10
5
0
25 23 2 21 12 7 24 26 13 22 14 27 9 16 5 19 15 20 6 11 18 8 17 10 1 3 28 4
Trauma Center

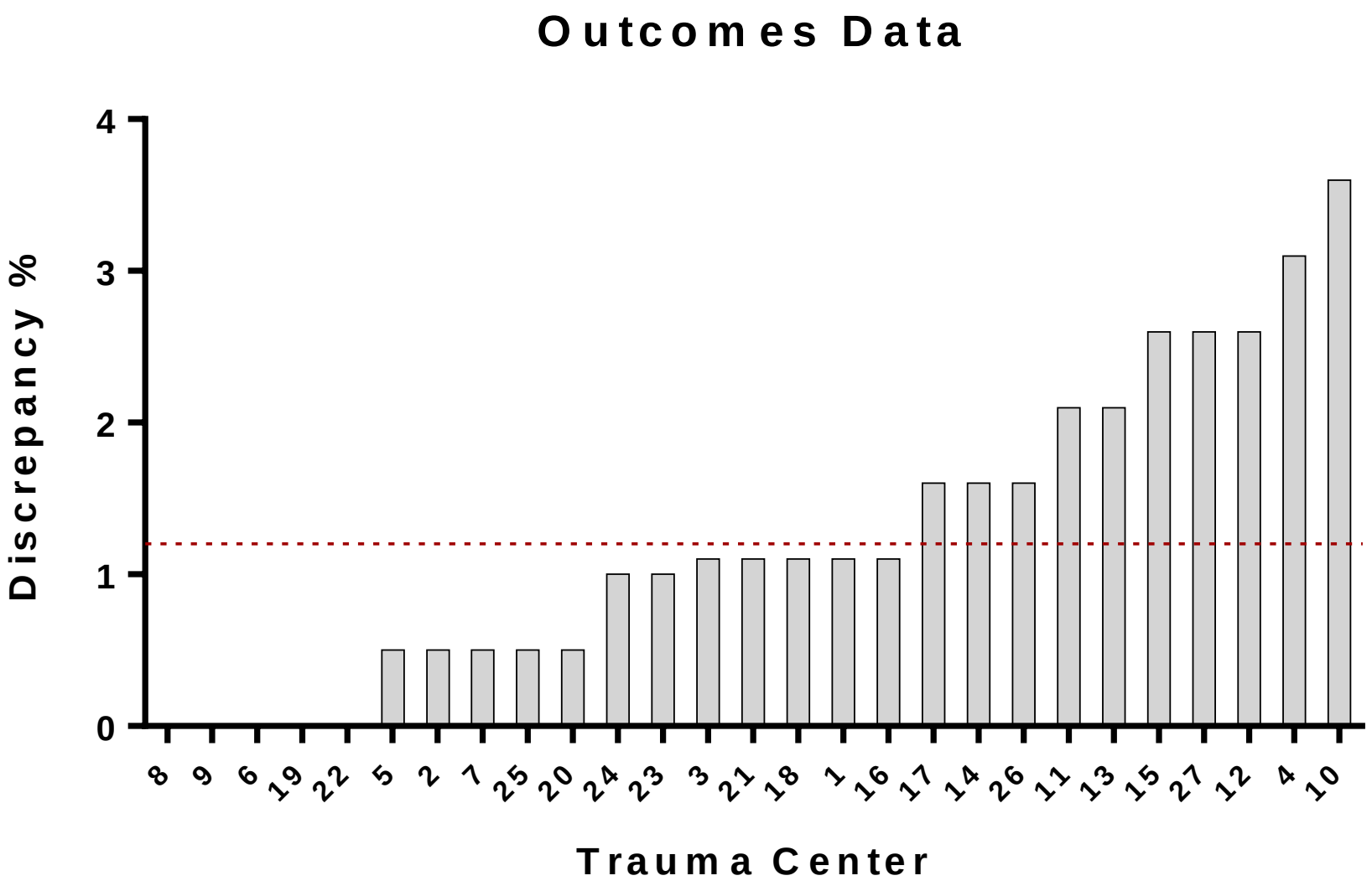
Pg. 29

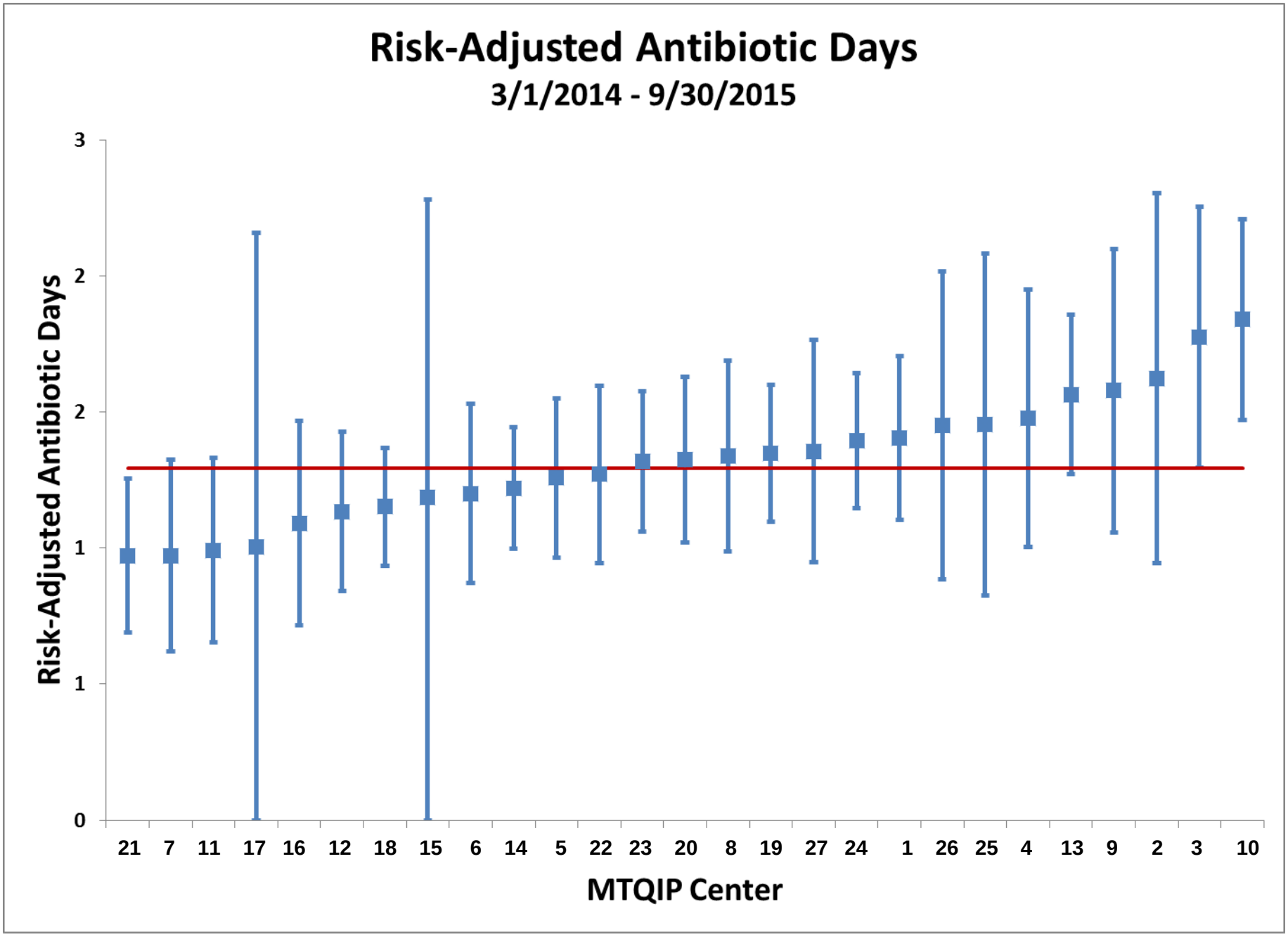

Pneumonia
%
6
4
2
0
10 4 2 14 21 15 24 18 28 23 26 8 12 16 20 17 9 22 6 25 7 5 13 3 1 11 27 19
Trauma Center

Pg. 29


Discharge Data
Discrepancy %
20
15
10
5
0
16 8 11 3 2 17 13 9 7 21 15 24 6 23 27 18 1 19 5 22 14 4 10 25 26 20 12
Trauma Center


Adjusted VAP
Pneumonia/1000 Vent Days
200
180
160
120
100
80
60
40
20
0
10
4
28
24
18
15
14
8
23
3
20
26
12
21
5
17
2
1
16
13
27
22
6
19
7
11
9
25
Trauma Center


Outcomes Data
Discrepancy %
0
1
2
3
4
8 9 6 19 22 5 2 7 25 20 24 23 3 21 18 1 16 17 14 26 11 13 15 27 12 4 10
Trauma Center


Risk-Adjusted Antibiotic Days
3/1/2014 - 9/30/2015
Risk-Adjusted Antibiotic Days
3
2
2
1
1
0
21 7 11 17 16 12 18 15 6 14 5 22 23 20 8 19 27 24 1 26 25 4 13 9 2 3 10
MTQIP Center

Treatment of Blunt Traumatic Aortic Injury

Himanshu Patel, MD
University of Michigan

Advances in Treatment of Traumatic Aortic Transection

Himanshu J. Patel MD

University of Michigan Medical Center

University of Michigan Health System

Author Disclosures

- Consulting fees from WL Gore Inc.

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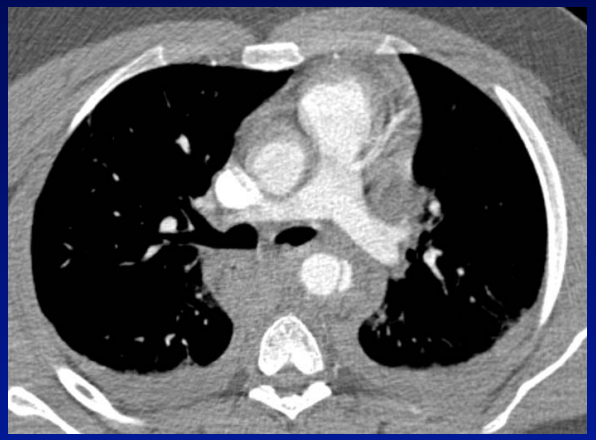
"There is no disease more conducive to clinical humility than aneurysm of the aorta"

Sir William Osler

University of Michigan Health System

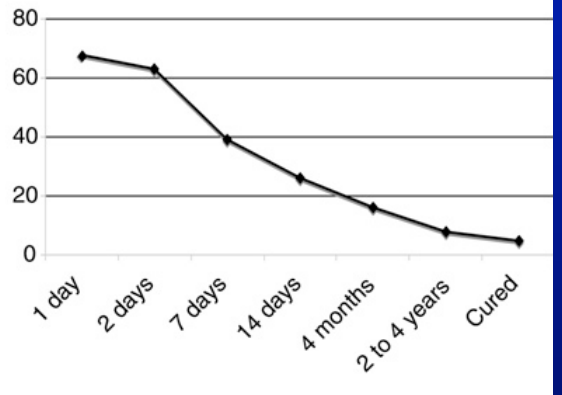
Natural History

- Pioneering work described natural history of untreated blunt thoracic aortic injury
  - Initial mortality rate at 24 hours was 34%
- Classic teaching of early aortic repair



Survival Times of Hospitalized Patients

Survival	
Time	Total (%)
1 day	12 (32)
2 days	2 (5)
7 days	9 (24)
14 days	5 (13)
4 months	4 (10)
2 - 4 years	4 (10)
Cured	2 (5)



Parmley, et al. 1958

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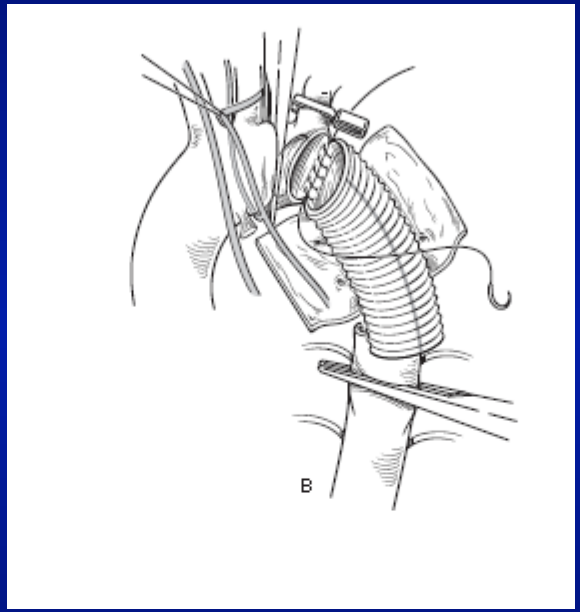
Prospective AAST-1 Study (1997)

- Immediate repair in 207 of 274 patients
- 31% mortality rate with 63% of deaths attributable to aortic rupture
- Paraplegia rate of 9%



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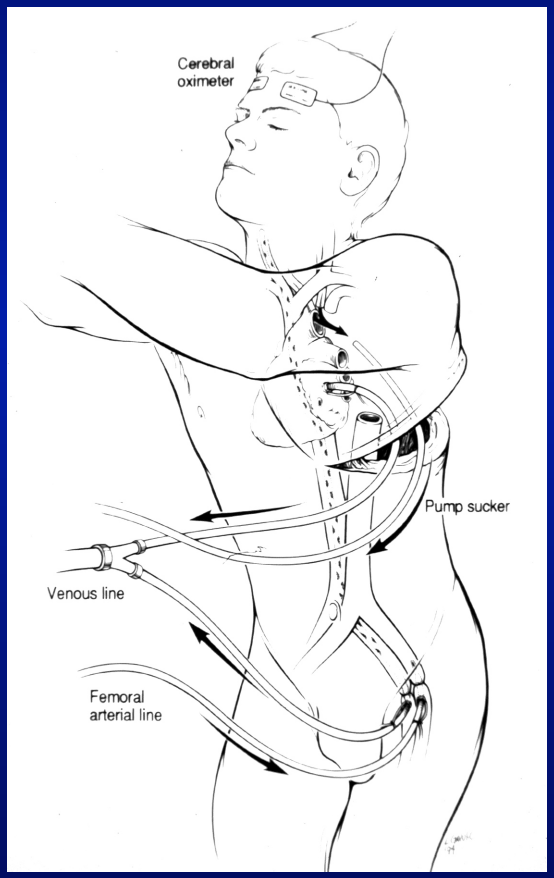
Contemporary Natural History

- Akins et. al. (1981) challenged dogma of immediate repair
- Recent autopsy study (242 patients) suggests
  - 57% dead at scene
  - 37% died in 1st 4 hours
  - 6% died thereafter



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Emerging Paradigm Shifts

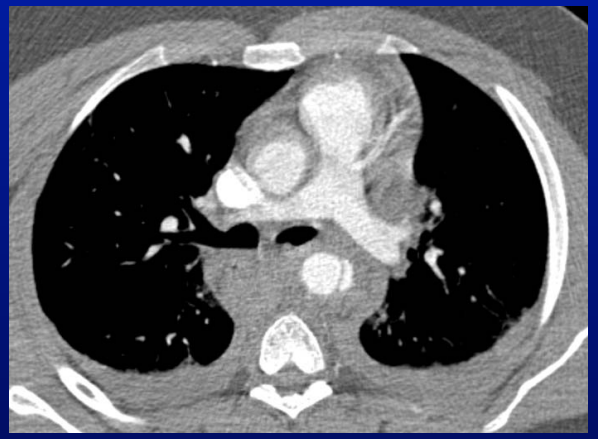
- Prospective study:
  - CT for early diagnosis
  - Prompt BP control eliminates rupture risk
  - Treat other life threatening injuries—e.g. closed head injury
  - Validated the concept of selective delayed repair

Prospective Study of Blunt Aortic Injury

Helical CT is Diagnostic and Antihypertensive Therapy Reduces Rupture

Timothy C. Fabian, MD,* Kimberly A. Davis, MD,* Morris L. Gavant, MD,† Martin A. Croce, MD,* Sherry M. Melton, MD,* Joe H. Patton, Jr., MD,* Constance K. Haan, MD,* Darryl S. Weiman, MD,* and James W. Pate, MD*

From the Departments of Surgery and Radiology,† University of Tennessee, Memphis, Tennessee*



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Are All Injuries Lethal?

- Sensitivity of CT scans
- Classification schema of Azzizadeh et. al.

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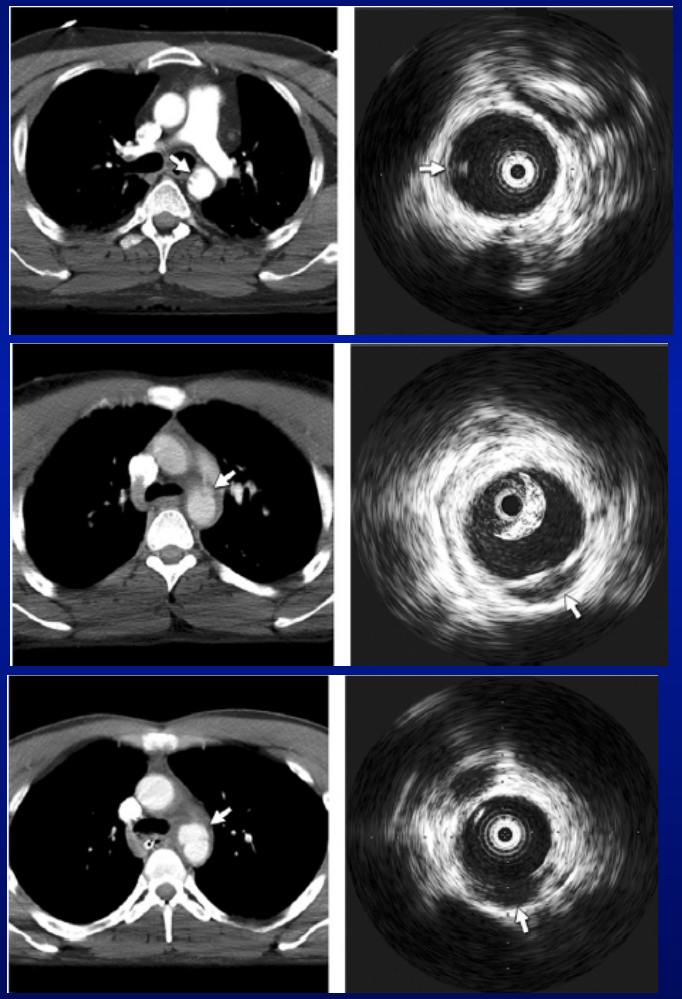
Extent of Injury Determines Therapy

- Grade 1—Intimal injury usually heals
- Grade 2—Intramural hematoma usually heals
- Grade 3—Pseudoaneurysm needs repair



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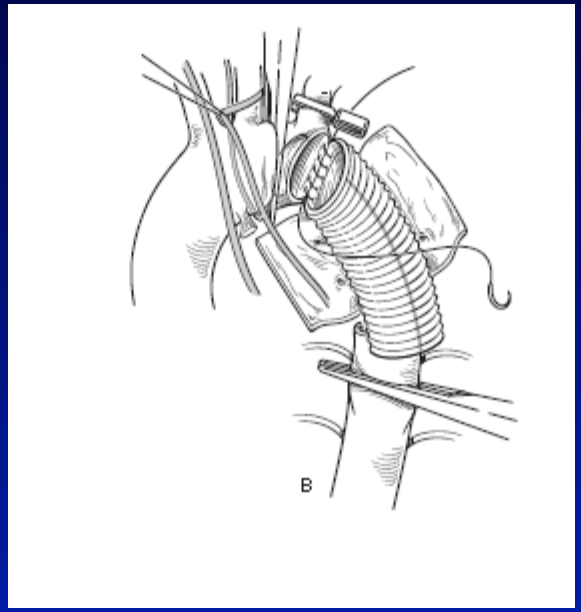
Therapeutic Options

- Open descending aortic repair
  - Thoracotomy
  - Single lung ventilation
  - Extracorporeal support with heparin use
- Thoracic endovascular repair



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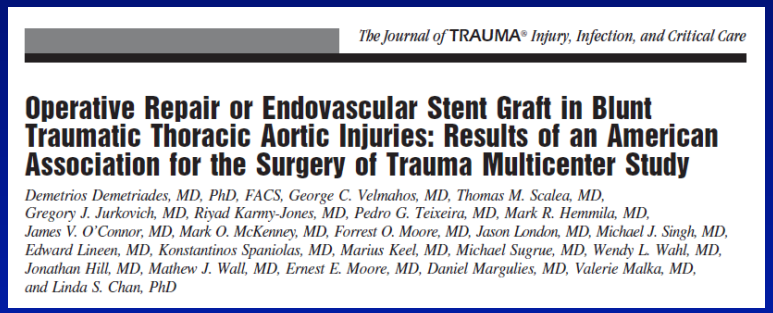
Prospective AAST-2 Study (2007)

- Increased utilization of selective delayed management in 198 patients
  - Improved survival
  - No impact of associated injury



The Journal of TRAUMA® Injury, Infection, and Critical Care

Operative Repair or Endovascular Stent Graft in Blunt Traumatic Thoracic Aortic Injuries: Results of an American Association for the Surgery of Trauma Multicenter Study

Demetrios Demetriades, MD, PhD, FACS, George C. Velmahos, MD, Thomas M. Scalea, MD, Gregory J. Jurkovich, MD, Riyad Karmy-Jones, MD, Pedro G. Teixeira, MD, Mark R. Hemmila, MD, James V. O'Connor, MD, Mark O. McKenney, MD, Forrest O. Moore, MD, Jason London, MD, Michael J. Singh, MD, Edward Lineen, MD, Konstantinos Spaniolas, MD, Marius Keel, MD, Michael Sugrue, MD, Wendy L. Wahl, MD, Jonathan Hill, MD, Mathew J. Wall, MD, Ernest E. Moore, MD, Daniel Margulies, MD, Valerie Malka, MD, and Linda S. Chan, PhD

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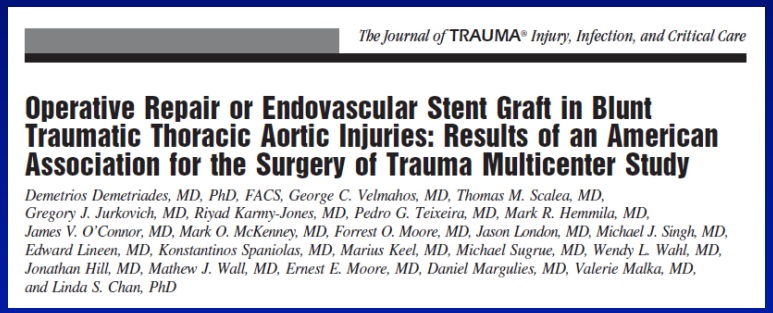
Prospective AAST Trial-2 (2007)

- Increased utilization of TEVAR in patients
  - Improved early survival
  - No difference in LOS, ICU stay, ventilator days or systemic complications
  - Reduction in transfusion requirements



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Type of Repair	N	%
Open	68	35
Clamp and Sew	11	6
Bypass	57	30
Endovascular	125	65
Total	193	

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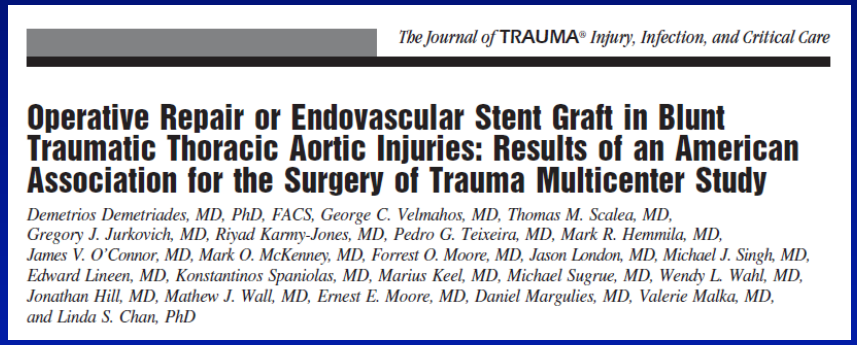
Prospective AAST Trial-2 (2007)

- Device related complications seen in 20% (n=25):
  - 9 of 25 required 2nd TEVAR procedure
  - 6 of 25 required open repair
  - Endograft collapse, branch vessel coverage, access vessel rupture



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Late Results of Repair of BTAI

- 109 patients treated from 1992-2010
- Selective delayed management in 72% treated since 1997
- TEVAR in 42% treated since 2002
  - Anatomical features considered high risk for rupture AND not open surgery candidate
    - Complete disruption
    - Lateral pseudoaneurysm
  - Age over 60 years

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Early Outcomes

- Early mortality (either in-hospital or 30-day)
  - 5 patients (4.6%) all who had open repair
- Stroke 2.8%
- Spinal cord ischemia 1.8%
- Permanent dialysis 1.8%

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Early Morbidity

- Composite outcome of early mortality, stroke, paraplegia or dialysis dependent renal failure

Independent Predictors	OR	*p* Value
Age > 60 years	8.4	0.015
Creatinine	7.9	0.017
Postoperative sepsis	9.6	0.021

- Repair type not predictive ($p = 0.4$)

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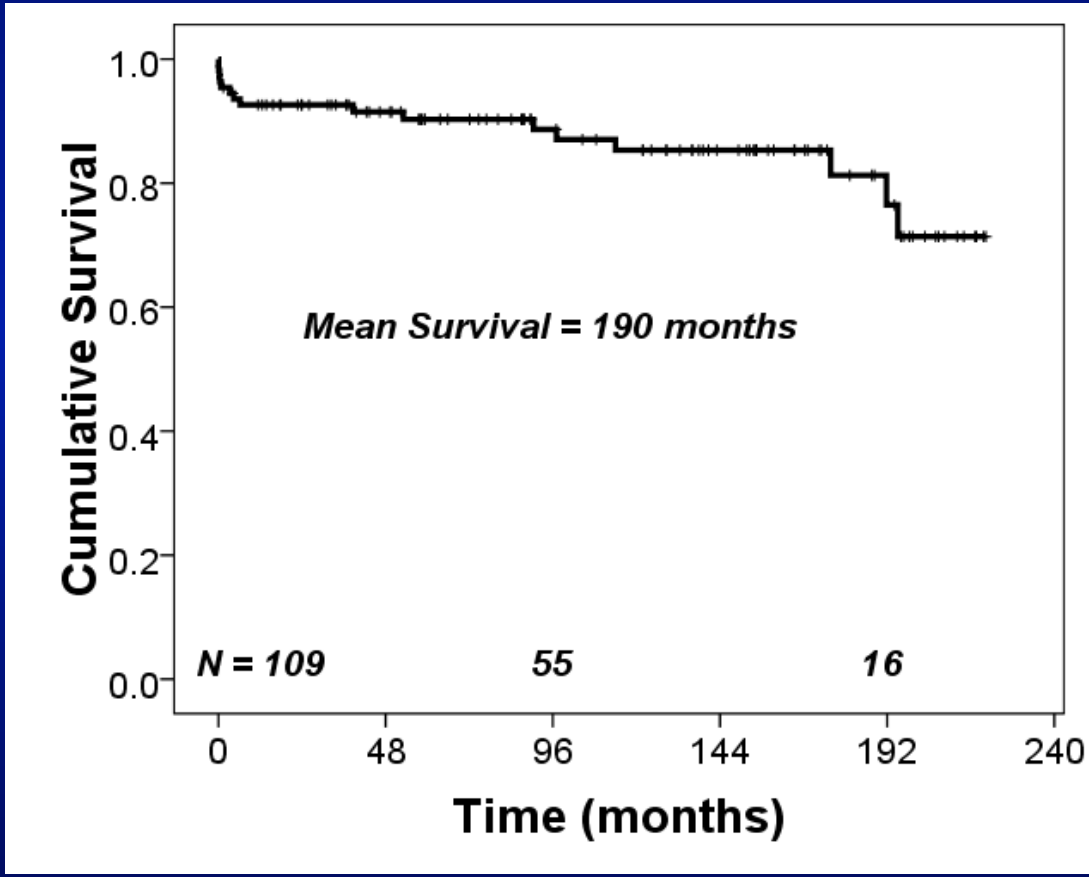
Survival Analysis---Entire Cohort



- 15 year Survival

  81.3%

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Late Mortality

Independent Predictors	HR	*p* Value
Age > 60 years	4.1	0.01
Creatinine	9.1	<0.001
Postoperative SCI	20.6	<0.001

- Repair type not predictive ($p = 0.7$)

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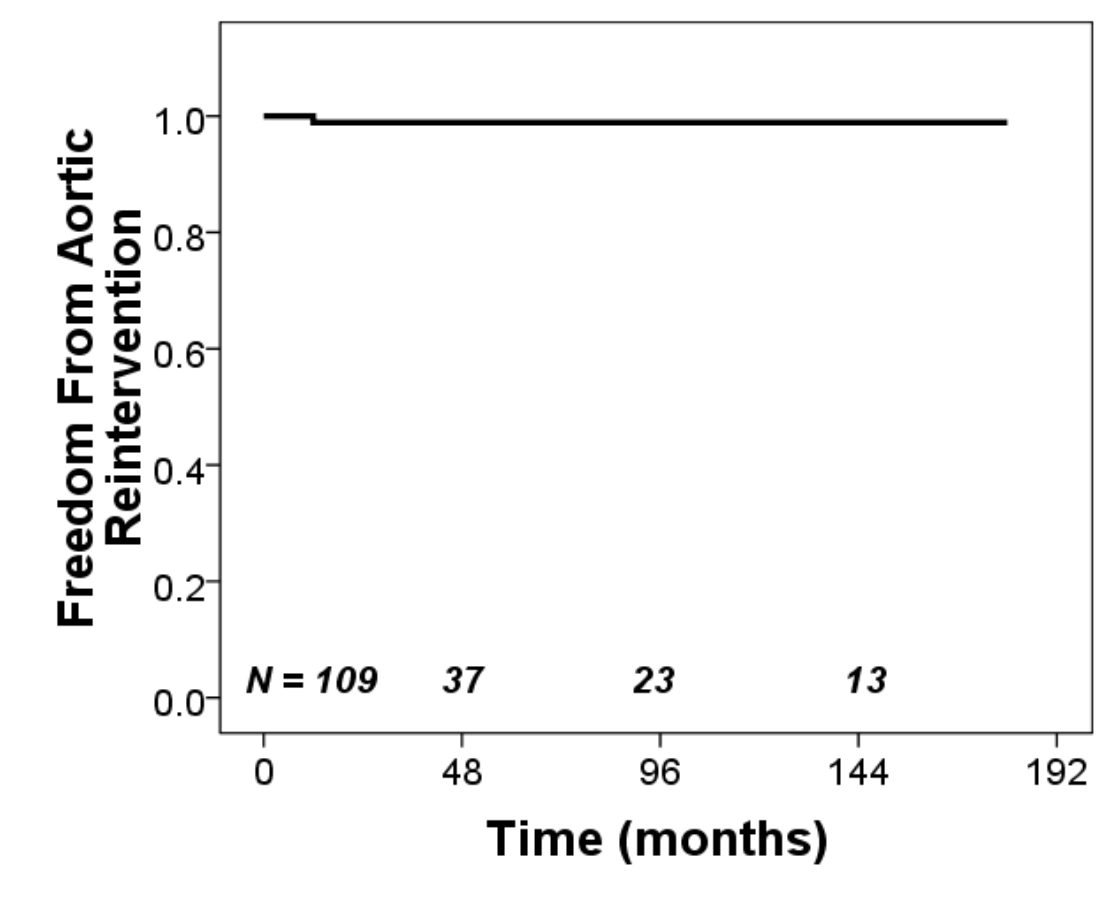
Late Aortic Reoperation—Entire Cohort



- 15 Year Freedom

  99.1%

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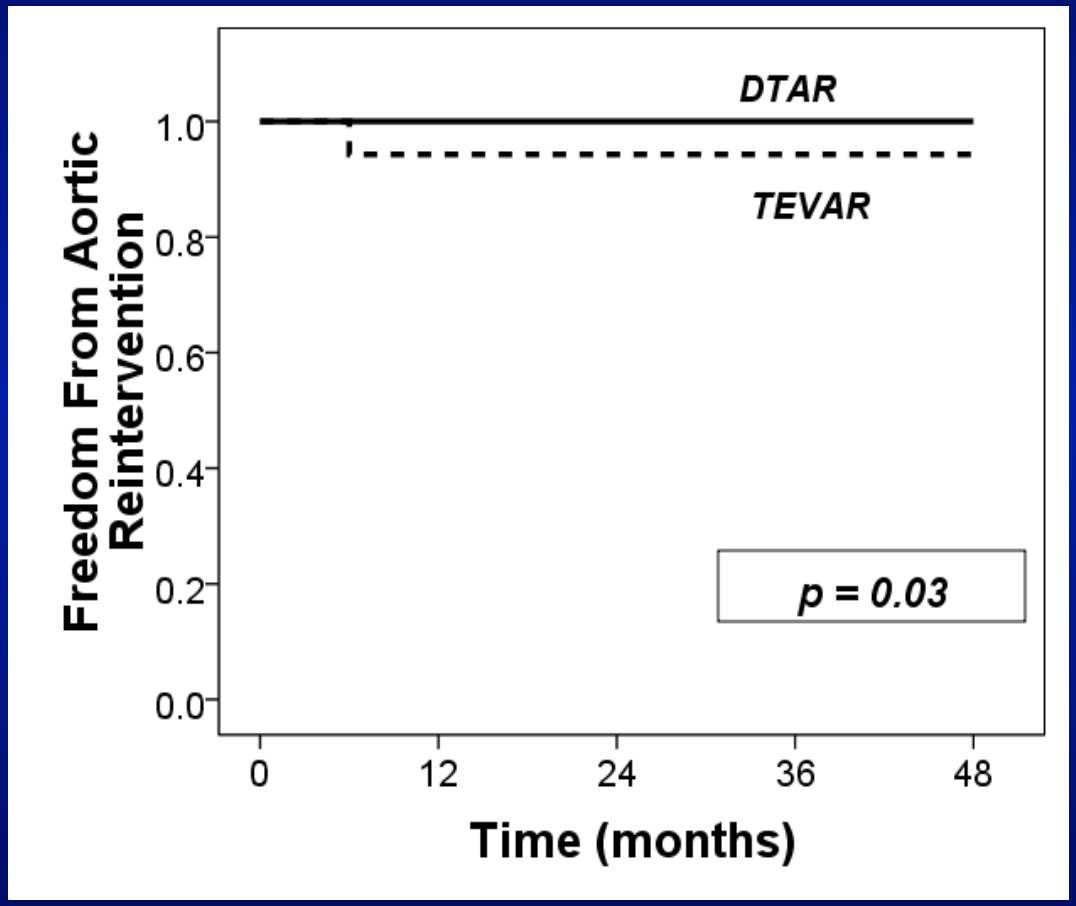
Late Aortic Reoperation



4 Year Freedom

- *DTAR*: 100%
- *TEVAR*: 94%

p=0.03

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Early Pitfalls in TEVAR for BTAI

- Beware the gothic arch and bird-beak in the young trauma patient

Vs.

•21 yr old

•71 yr old

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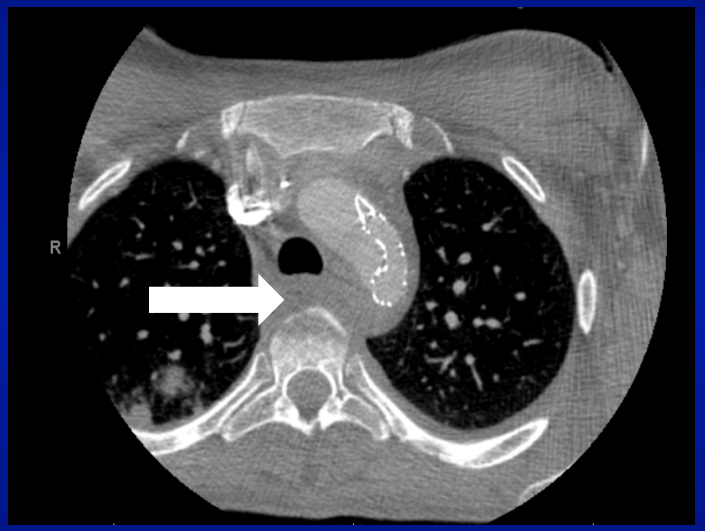
Early Pitfalls in TEVAR for BTAI

- Volume resuscitation increases aortic diameter by at least 10%
  - Oversizing of endografts may predispose to endograft collapse
- Remember circle of Willis
  - Pre-TEVAR left carotid to left subclavian arterial bypass should be considered



University of Michigan Health System

Late Pitfalls in TEVAR for BTAI

- Aortic diameter grows by up to 1 cm from 20-80 years of age
- Many young patients will not return for follow-up imaging required for TEVAR
  - Imaging follow-up in our study was 50 months vs. 104 months obtained for primary endpoint of vital status from SSDI

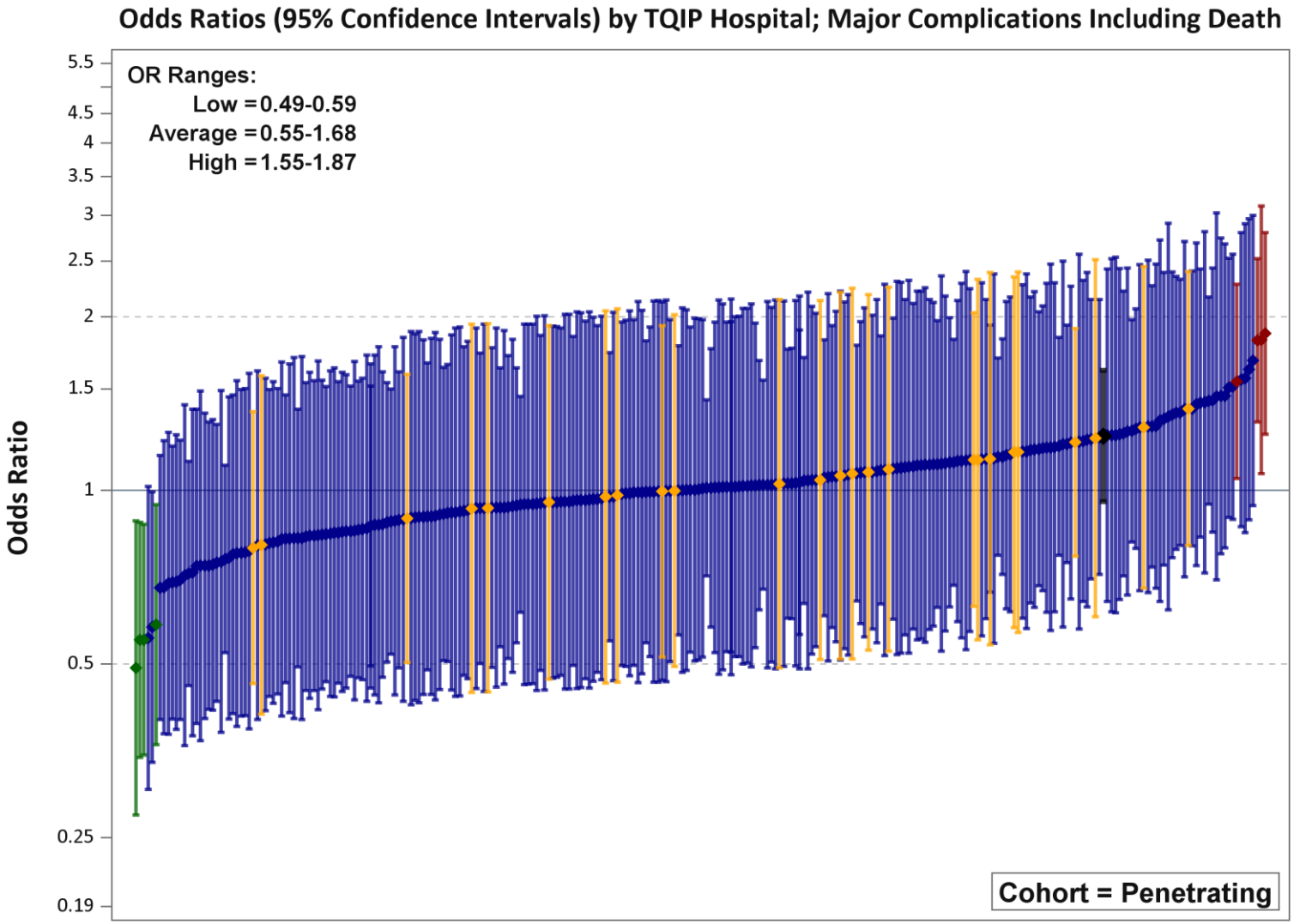
Summary

1. Repair for BTAI can be performed with excellent early and late results—gold standard remains open repair.
2. With careful selection of candidates for TEVAR, factors other than treatment strategy may impact late survival.
3. Risk for re-intervention remains higher in the TEVAR subset thus providing strong motivation to develop devices tailored to this pathology.

ACS-TQIP and MTQIP Reports

Mark Hemmila, MD
University of Michigan

Confused


Odds Ratios (95% Confidence Intervals) by TQIP Hospital; Major Complications Including Death
OR Ranges:
Low = 0.49-0.59
Average = 0.55-1.68
High = 1.55-1.87
Odds Ratio
5.5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0.25
0.19
Cohort = Penetrating

ACS TQIP BENCHMARK REPORT:

ACS tqip® TRAUMA QUALITY IMPROVEMENT PROGRAM

AMERICAN COLLEGE OF SURGEONS

Inspiring Quality:
Highest Standards, Better Outcomes

COMMITTEE ON TRAUMA

Inclusion and Exclusion Criteria

- ACS-TQIP
  - ICD-9 in Trauma Range
  - AIS 05 → AIS 98
  - AIS 90 or 95 → AIS 98
  - ICD-9 → AIS 98
  - AIS ≥ 3 one body region
  - Age ≥ 16
  - Trauma type blunt or penetrating
- MTQIP
  - ICD-9 in Trauma Range
  - AIS 2005
  - ISS ≥ 5
  - Age ≥ 16
  - Trauma type blunt or penetrating

Inclusion and Exclusion Criteria

- ACS-TQIP
  - Exclude ED disp home, other, LAMA, transfer
  - Exclude pre-existing advance directive
  - Exclude patients with the following combinations of ED vitals:
    - SBP=0, and Pulse=0, and GCS Motor=1
    - SBP=NK/NR, and Pulse=0, and GCS Motor=1
    - SBP=0, and Pulse=0, and GCS Motor=NK/NR
    - SBP=0, and Pulse=NK/NR, and GCS Motor=1
    - SBP=NK/NR, and Pulse=0, and GCS Motor=NK/NR
- MTQIP
  - Exclude if LOS < 24 hrs and alive

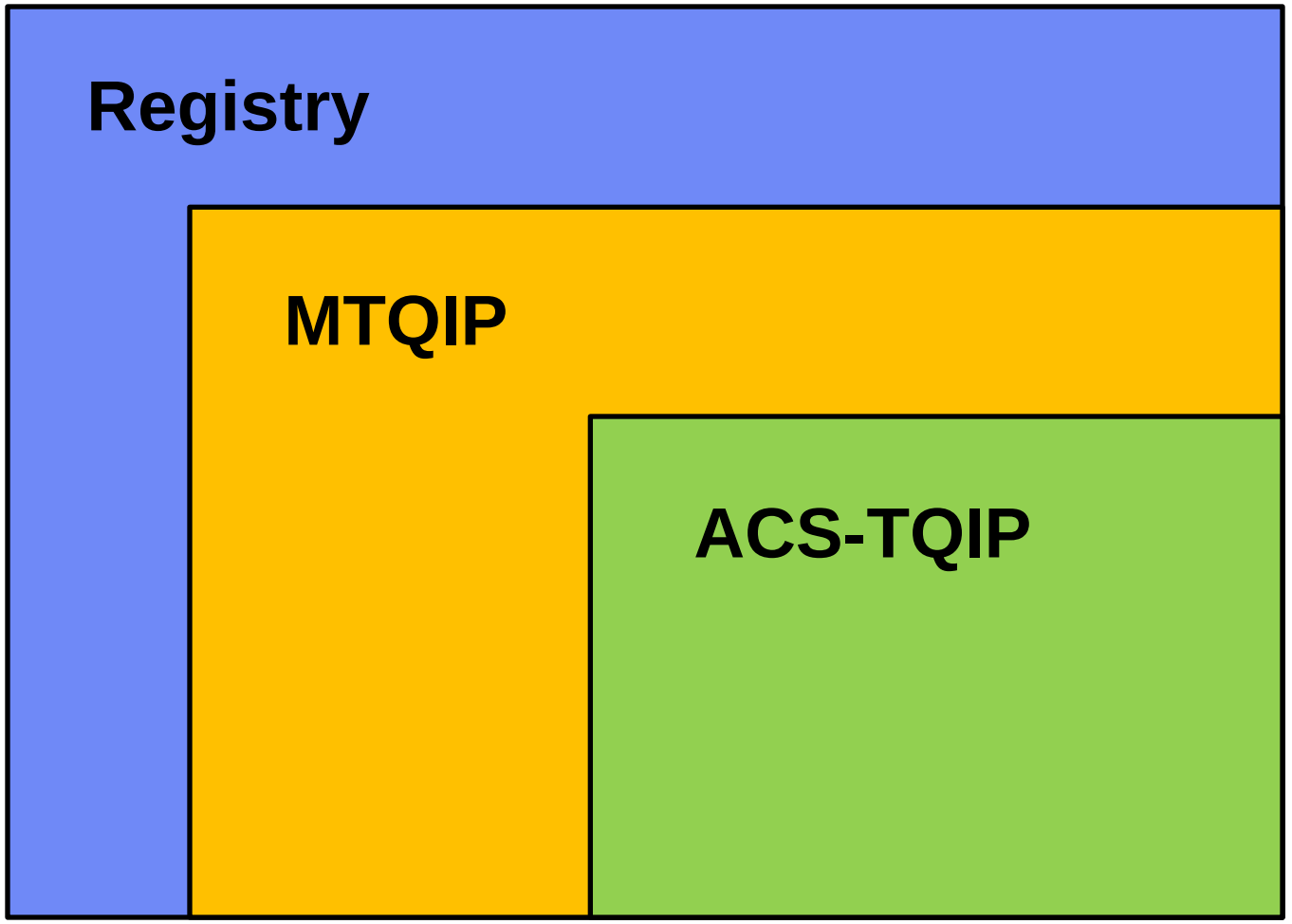
Inclusion and Exclusion Criteria

- ACS-TQIP
  - Exclude isolated hip fracture
  - Separate analysis
- MTQIP

Pre-existing Advance Directive

- MTQIP
  - 102,751 Patients
  - 2,870 (2.8%) with pre-existing advance directive
  - Range 0.2% to 11.2%
  - 17% Died
  - 83% Discharged alive

Data



Analysis, n's, and Reliability Adjustment

Table 2: Risk-Adjusted Mortality by Cohort

	Mortality	Odds Ratio and 95% Confidence Interval	
Cohort			
All			
Blunt Multisystem			
Penetrating			
Shock			
TBI			
Intubated TBI			
Severe TBI			
Elderly			
Elderly Blunt Multisystem			
IHF			

Reports

- Mortality
- Cohort = All Patients

TQIP#	N	Deaths	OR	Lower	Upper
248	318	13	0.59	0.36	0.96
277	271	7	0.61	0.36	1.03
148	257	11	0.7	0.43	1.15
87	1020	64	0.72	0.51	1
123	395	14	0.81	0.51	1.28
108	479	31	0.82	0.52	1.28
66	421	13	0.82	0.51	1.33
214	243	13	0.85	0.53	1.39
120	260	11	0.88	0.51	1.52
162	280	16	0.88	0.53	1.45
100	550	24	0.9	0.61	1.33
152	449	21	0.9	0.59	1.37
151	520	24	0.9	0.59	1.37
30	263	24	0.93	0.58	1.5
149	615	38	0.97	0.68	1.38
31	255	10	1.05	0.61	1.79
209	179	15	1.05	0.61	1.8
91	269	19	1.09	0.66	1.79
119	401	18	1.14	0.7	1.85
86	595	50	1.26	0.88	1.79
29	519	40	1.27	0.86	1.86
79	530	42	1.33	0.91	1.95
134	372	26	1.33	0.87	2.02
99	203	16	1.34	0.79	2.27
122	809	74	1.54	1.15	2.06
138	312	28	1.57	1	2.44
105	423	36	1.78	1.17	2.72

Reports

- Mortality
- Cohort = Blunt Multisystem

TQIP#	N	Deaths	OR	Lower	Upper
87	223	25	0.72	0.46	1.12
209	32	5	0.85	0.46	1.58
148	33	4	0.87	0.48	1.56
123	27	1	0.87	0.46	1.66
277	24	1	0.9	0.48	1.72
120	36	2	0.93	0.49	1.79
248	13	2	0.96	0.49	1.84
66	40	4	0.96	0.52	1.77
214	14	1	0.96	0.49	1.9
149	70	11	0.96	0.57	1.6
100	63	3	0.98	0.53	1.81
152	56	7	0.98	0.56	1.72
30	18	5	0.98	0.52	1.84
91	27	3	1	0.53	1.89
99	32	5	1.01	0.56	1.85
162	41	5	1.02	0.56	1.87
134	46	9	1.02	0.57	1.81
31	26	2	1.03	0.53	2
79	96	13	1.04	0.62	1.75
122	95	16	1.05	0.65	1.68
29	109	16	1.08	0.66	1.75
151	51	5	1.09	0.59	2
86	54	9	1.09	0.61	1.95
138	38	6	1.09	0.6	2.01
119	31	6	1.15	0.61	2.17
108	49	10	1.21	0.67	2.19
105	82	14	1.28	0.74	2.21

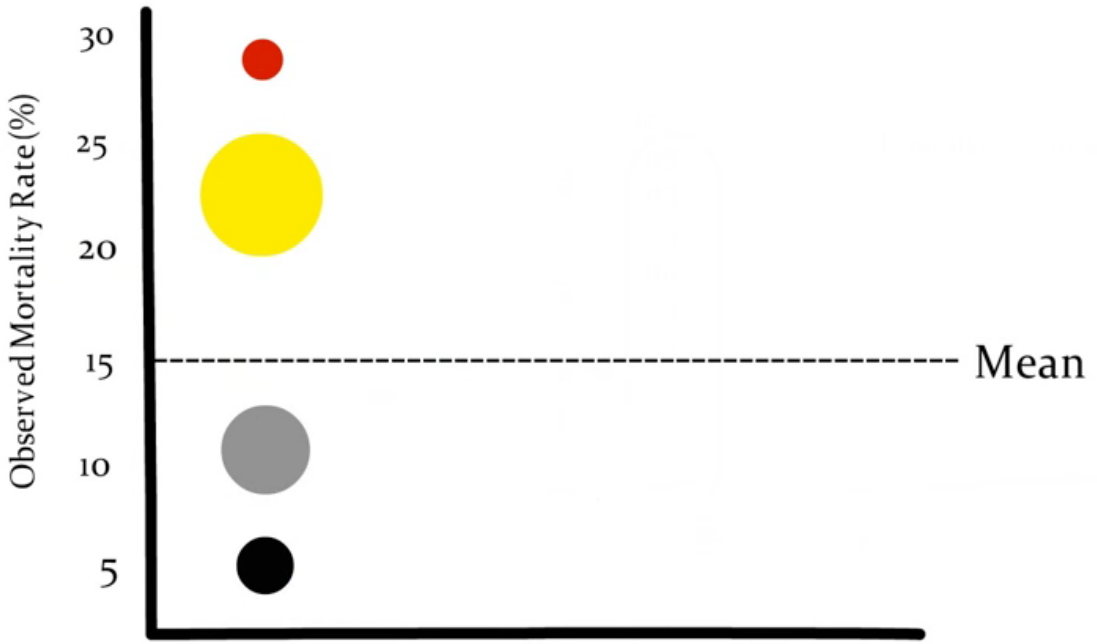
Reports

- Mortality
- Cohort = Shock

TQIP#	N	Deaths	OR	Lower	Upper
87	33	7	0.92	0.62	1.37
119	32	2	0.92	0.61	1.39
151	18	1	0.94	0.62	1.42
30	10	1	0.97	0.64	1.47
134	17	3	0.97	0.64	1.45
248	2	1	0.99	0.66	1.5
120	12	2	0.99	0.66	1.49
31	4	1	0.99	0.65	1.49
138	6	0	0.99	0.65	1.5
214	7	2	1	0.66	1.51
91	5	1	1	0.66	1.51
86	22	3	1	0.67	1.5
99	2	1	1	0.66	1.52
277	2	1	1.01	0.67	1.53
123	25	4	1.01	0.68	1.5
66	11	2	1.01	0.67	1.51
100	13	3	1.01	0.68	1.51
152	13	3	1.01	0.67	1.52
105	14	1	1.01	0.67	1.52
162	6	2	1.02	0.67	1.54
108	30	11	1.03	0.69	1.53
29	30	9	1.03	0.69	1.52
79	12	6	1.03	0.57	1.87
148	5	3	1.04	0.69	1.57
209	12	4	1.04	0.69	1.57
149	14	7	1.07	0.71	1.61
122	27	9	1.09	0.73	1.64

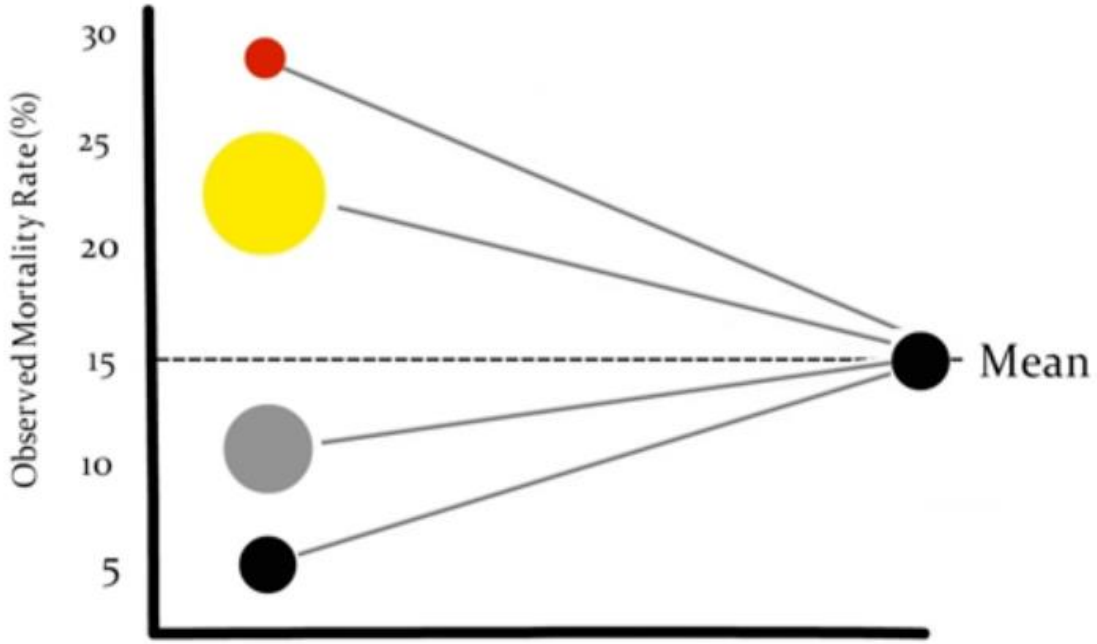
Why? – Reliability Adjustment

How does reliability adjustment transform outcomes conceptually?



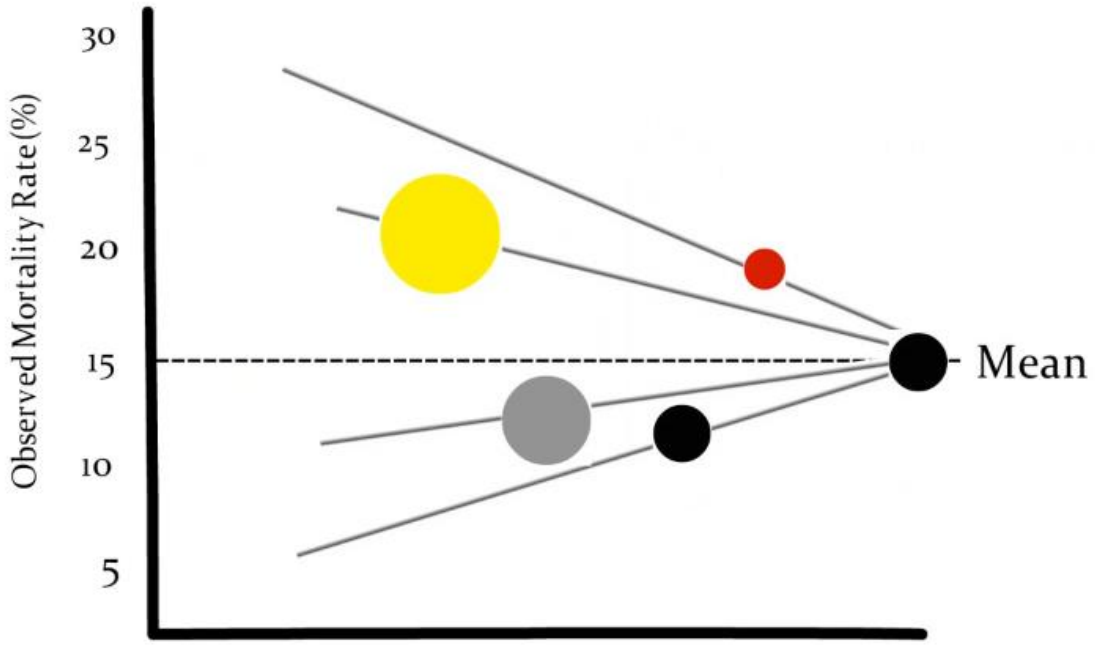
Why? – Reliability Adjustment

How does reliability adjustment transform outcomes conceptually?

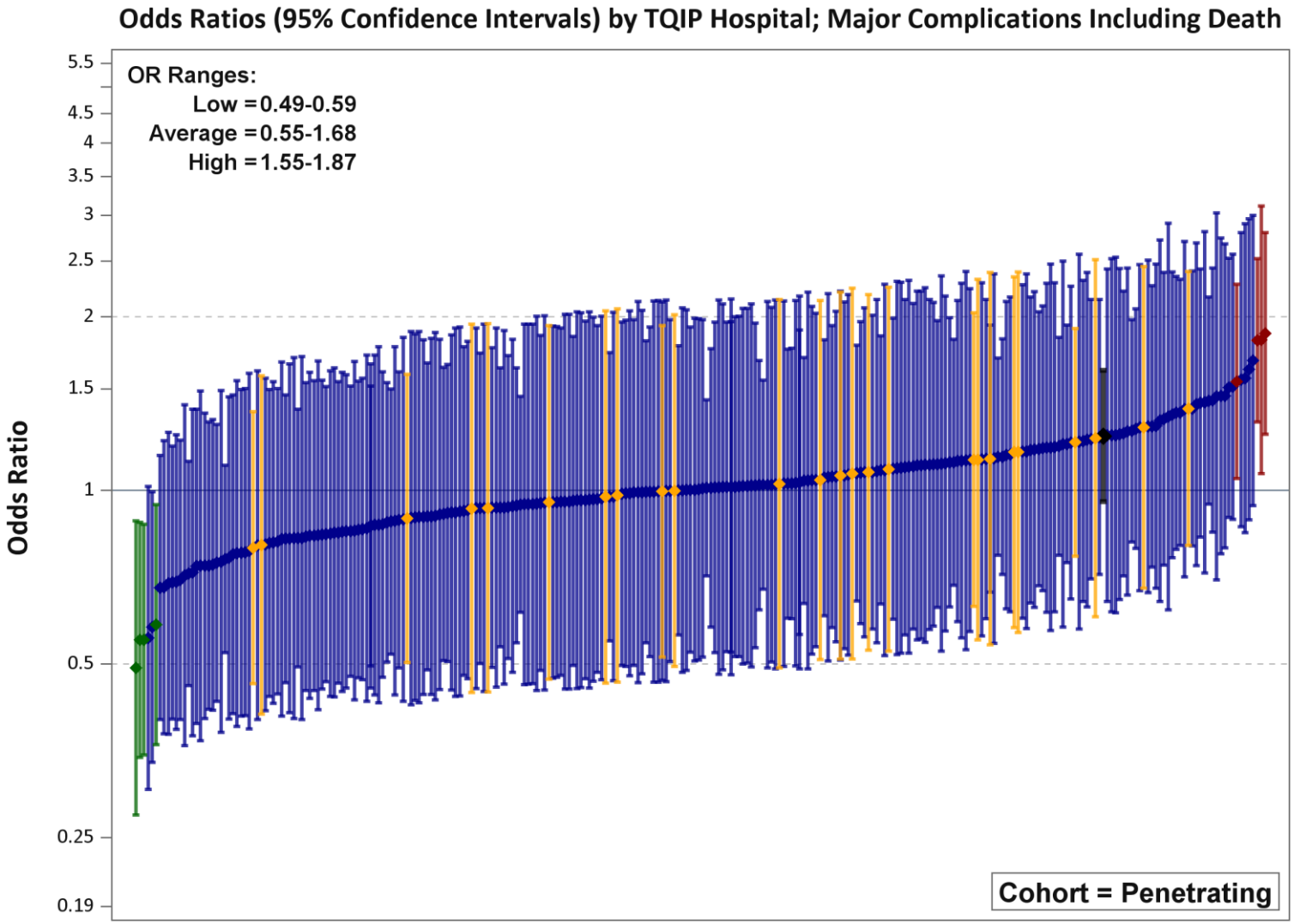


Why? – Reliability Adjustment

How does reliability adjustment transform outcomes conceptually?



No Longer Confused



Science

Original Investigation

Reliability of Risk-Adjusted Outcomes for Profiling Hospital Surgical Quality

Robert W. Krell, MD; Ahmed Hozain, BS; Lillian S. Kao, MD, MS; Justin B. Dimick, MD, MPH

Reliability of Superficial Surgical Site Infections as a Hospital Quality Measure

Lillian S Kao, MD, MS, FACS, Amir A Ghaferi, MD, MS, Clifford Y Ko, MD, MS, MSHS, FACS, Justin B Dimick, MD, MPH, FACS

Reliability

- Like Power
- Function of
  - Signal to Noise
  - Size of cohort
  - Prevalence of outcome

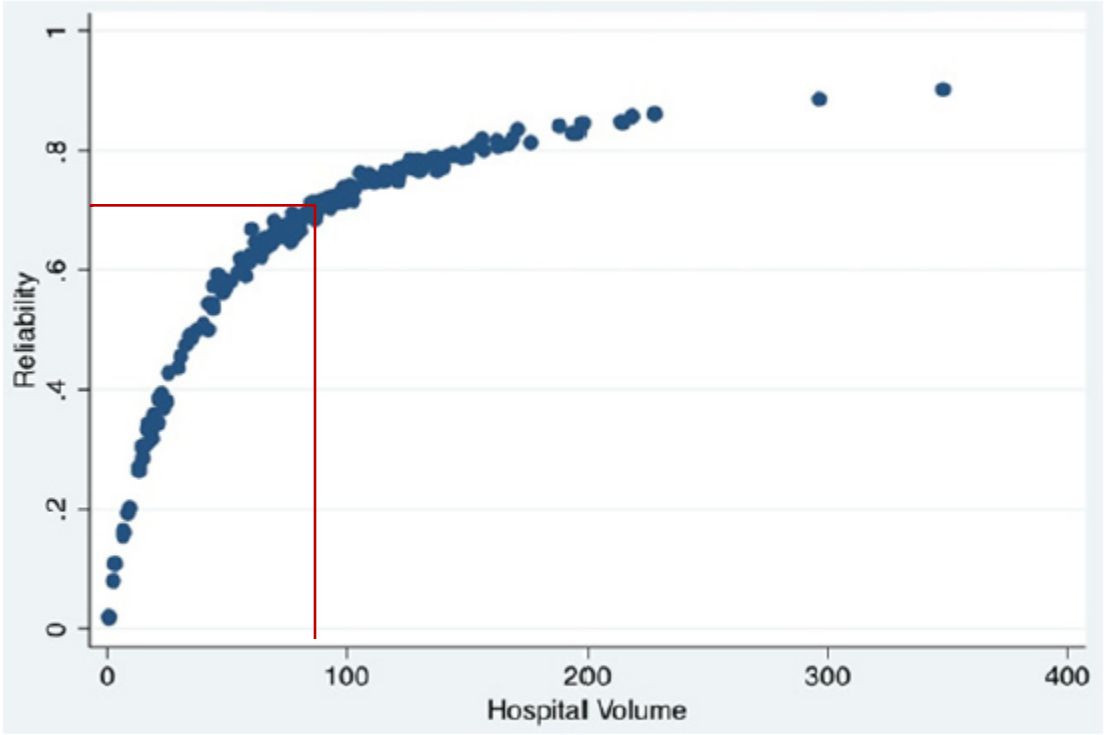


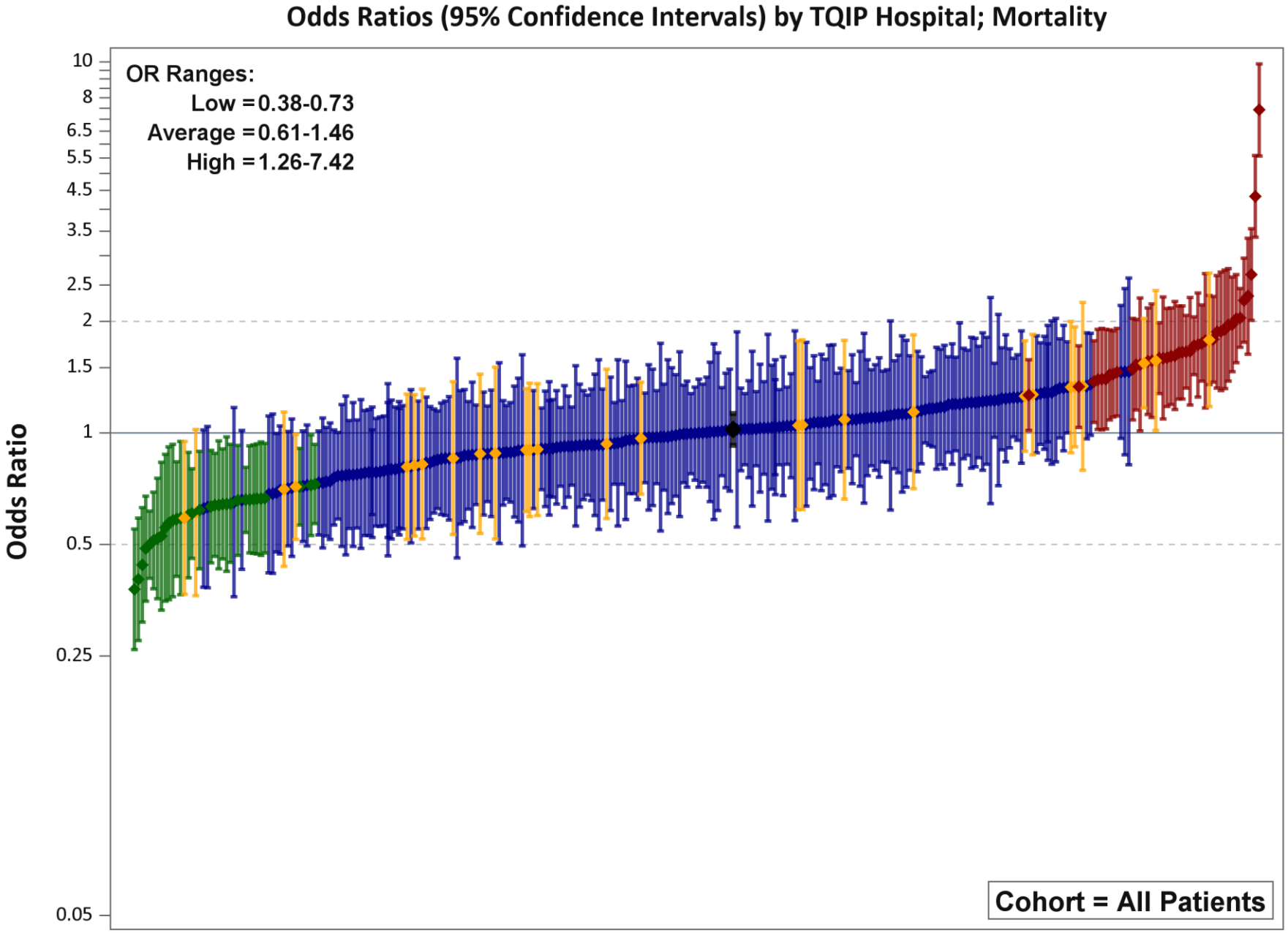
Figure 2. Relationship between reliability and hospital caseload of colon resections based on the American College of Surgeons National Surgical Quality Improvement Program 2007 database.

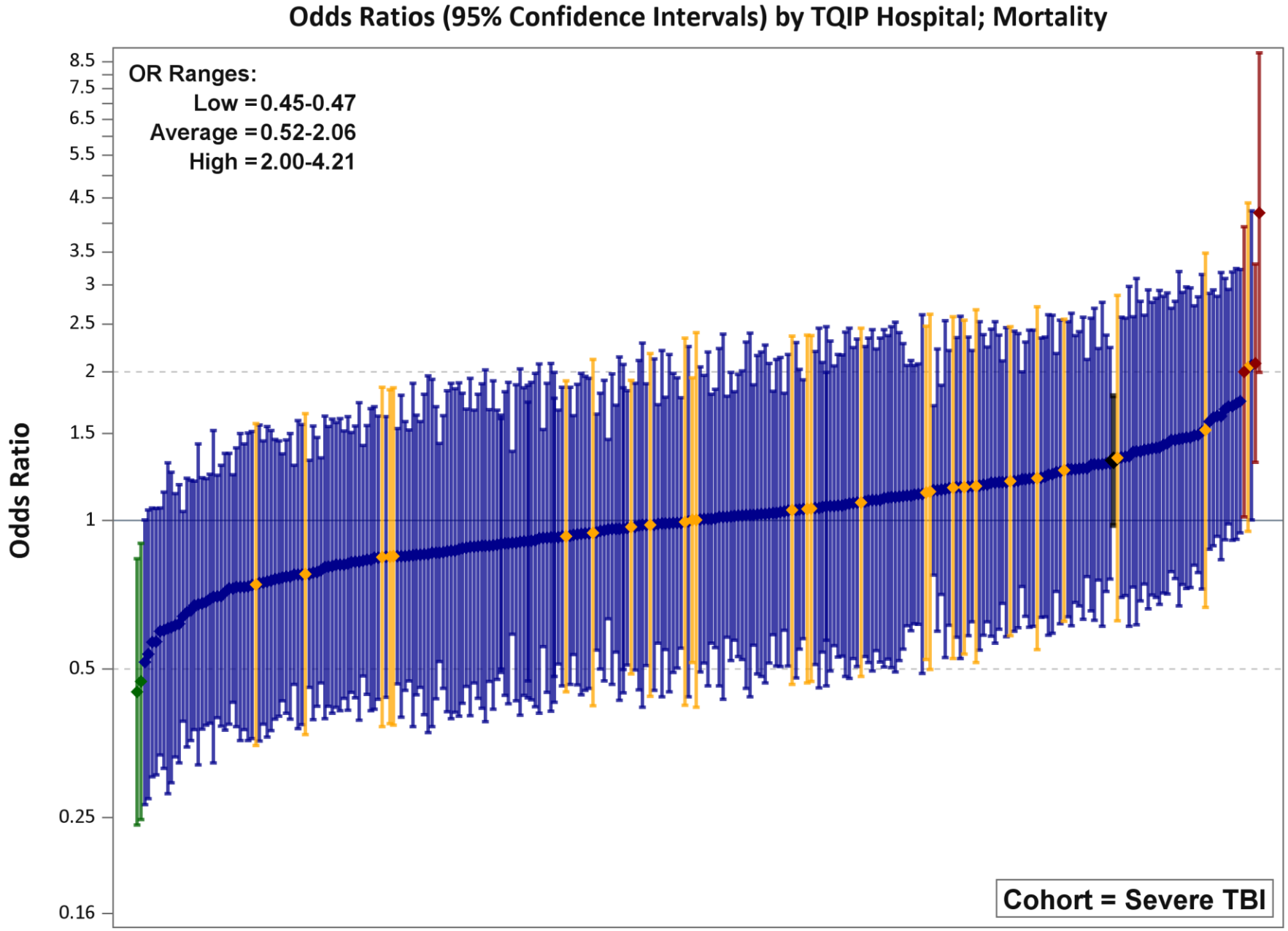
What I now know

- State Values
  - Probably real
  - Individual centers move to mean with small n's
  - Michigan as a large group does not
- Data Validation
  - MTQIP Data Validation Program
  - ACS-TQIP ?
  - Complications ↑
  - BMC2 has similar problem

What I think may be true for trauma centers in Michigan

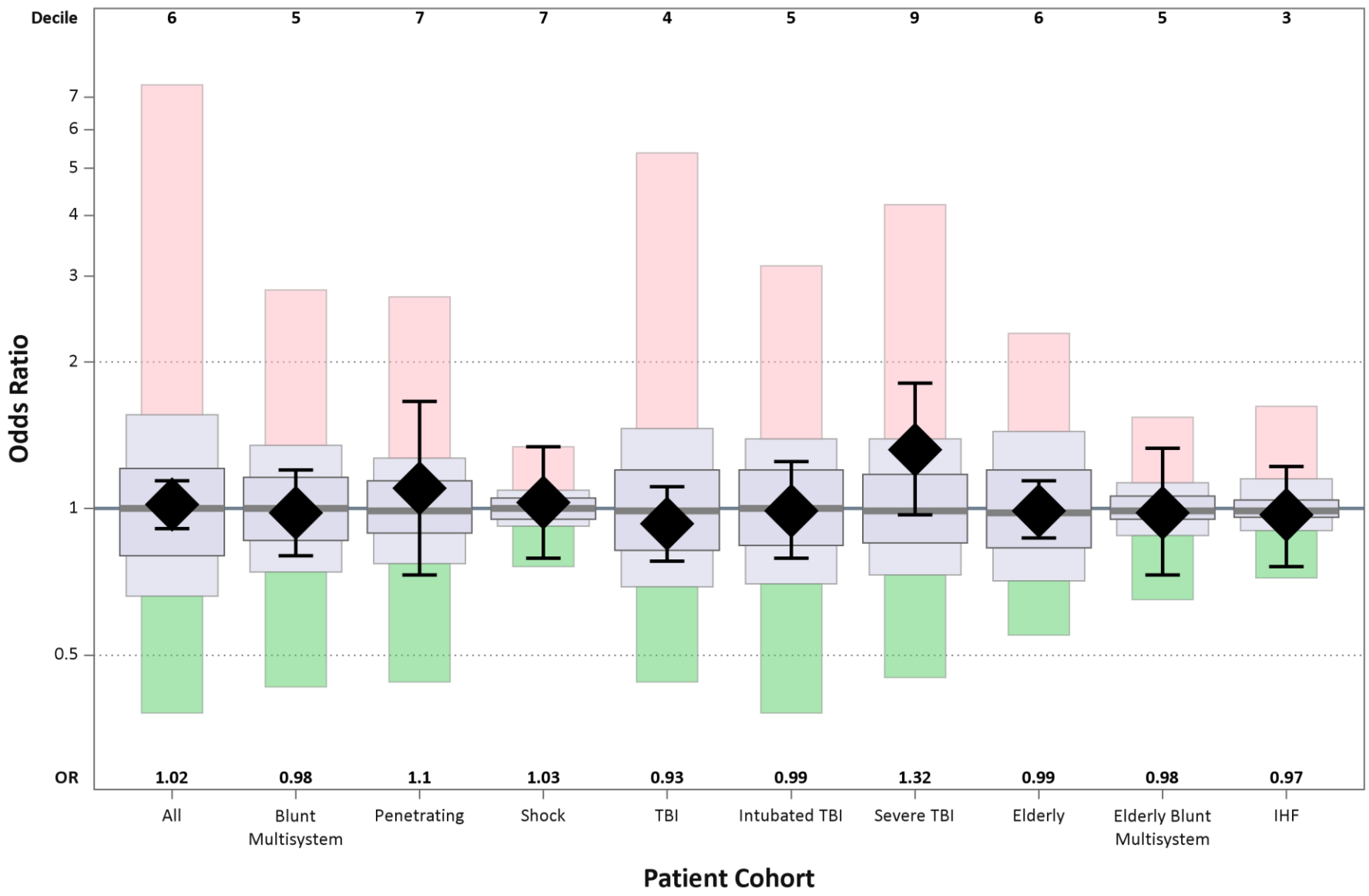
- Hospital ACS-TQIP values
  - Mortality: 10 reports, 2-3 sufficient power
  - Complications: 10 reports, 2-3 sufficient power
  - Mortality or Comp: 10 reports, 2-3 sufficient power
  - Complication in select group: 3 reports, 0 sufficient power
  - 33 reports, 9 (27%) with power to tell differences
  - Cohort = All Patients
  - Cohort = Blunt Multisystem
  - Cohort = Elderly


Odds Ratios (95% Confidence Intervals) by TQIP Hospital; Mortality
OR Ranges:
Low = 0.38-0.73
Average = 0.61-1.46
High = 1.26-7.42
Odds Ratio
10
8
6.5
5.5
4.5
3.5
2.5
2
1.5
1
0.5
0.25
0.05
Cohort = All Patients

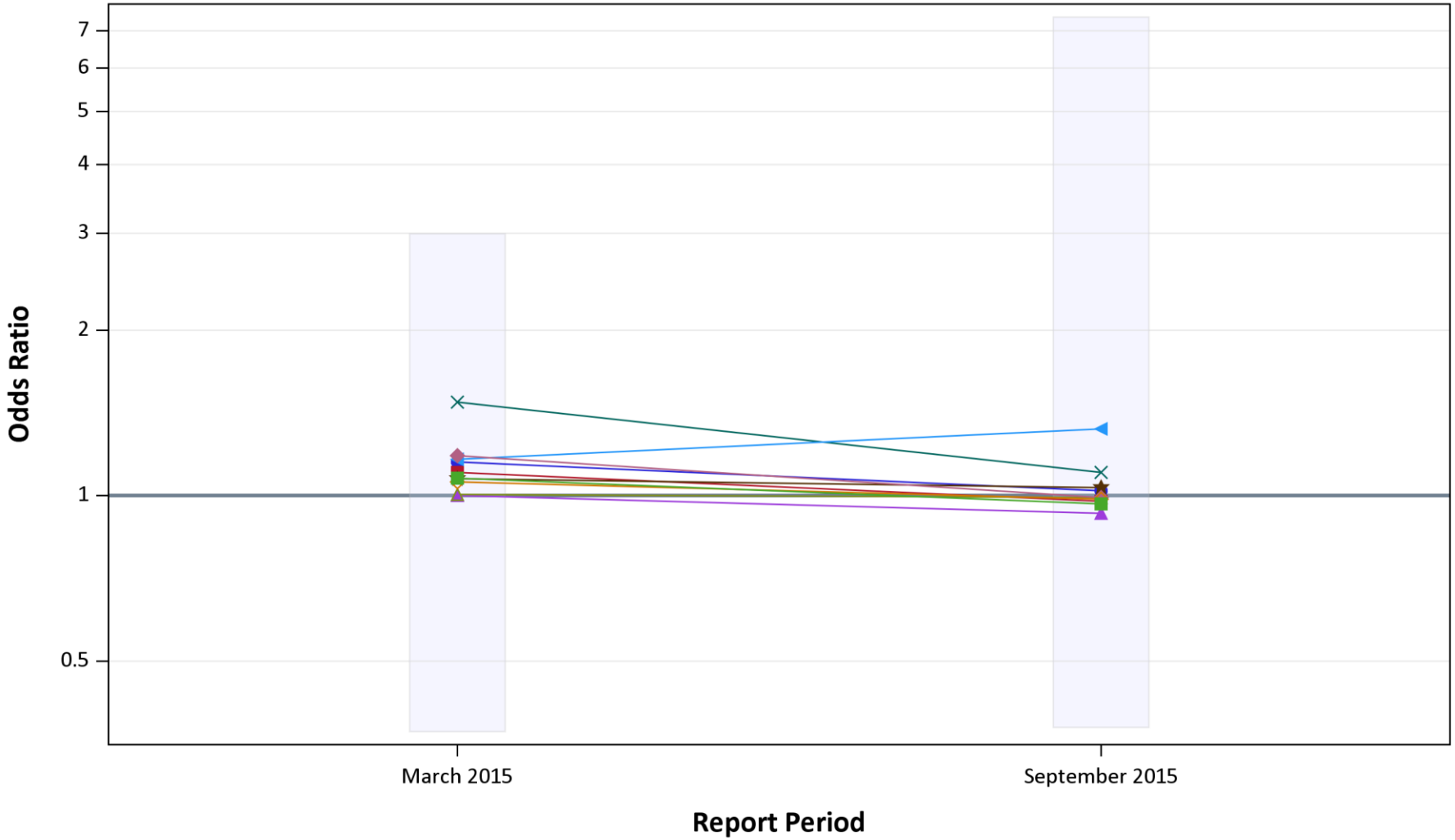

Odds Ratios (95% Confidence Intervals) by TQIP Hospital; Mortality
OR Ranges:
Low = 0.45-0.47
Average = 0.52-2.06
High = 2.00-4.21
Odds Ratio
8.5
7.5
6.5
5.5
4.5
3.5
3
2.5
2
1.5
1
0.5
0.25
0.16
Cohort = Severe TBI

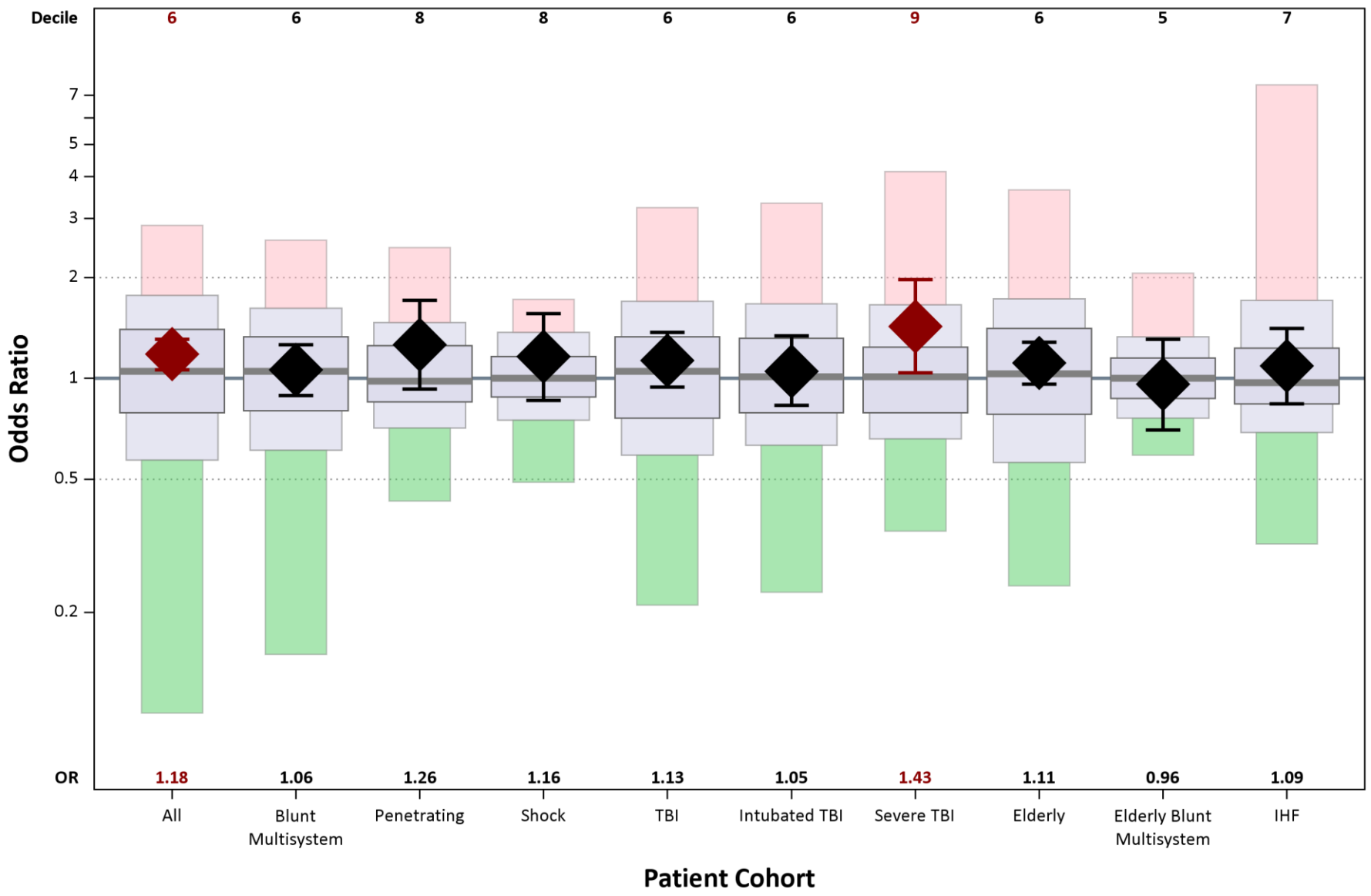
ACS-TQIP State Report

Mark Hemmila, MD
University of Michigan


Risk-Adjusted Mortality by Cohort
TQIP Report ID: Michigan
Decile
6
5
7
7
4
5
9
6
5
3
Odds Ratio
7
6
5
4
3
2
1
0.5
OR
1.02
0.98
1.1
1.03
0.93
0.99
1.32
0.99
0.98
0.97
All
Blunt Multisystem
Penetrating
Shock
TBI
Intubated TBI
Severe TBI
Elderly
Elderly Blunt Multisystem
IHF
Patient Cohort

Risk-Adjusted Mortality by Reporting Period and Cohort
TQIP Report ID: Michigan




Risk-Adjusted Major Complications by Cohort
TQIP Report ID: Michigan
Decile
6
6
8
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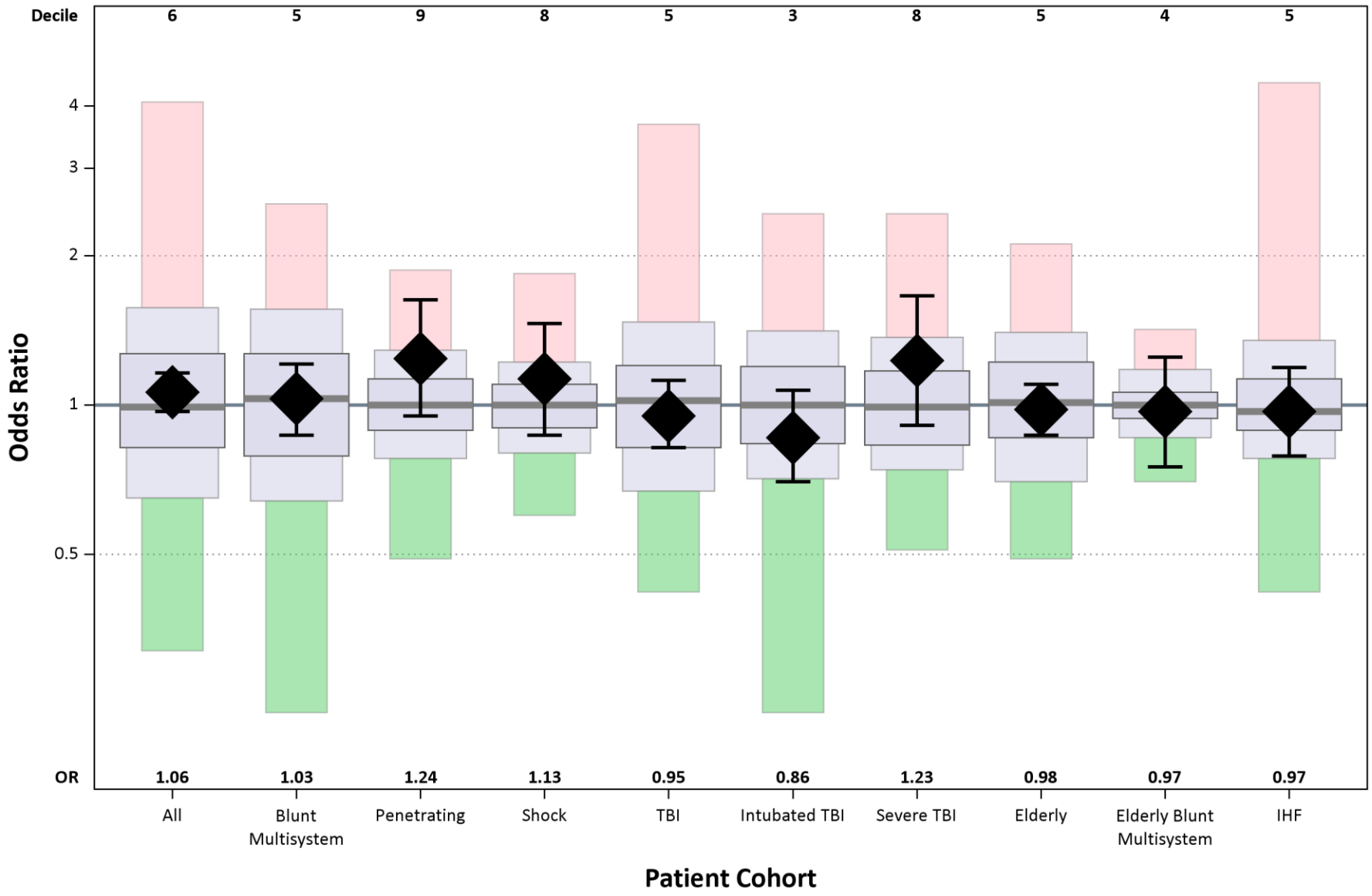
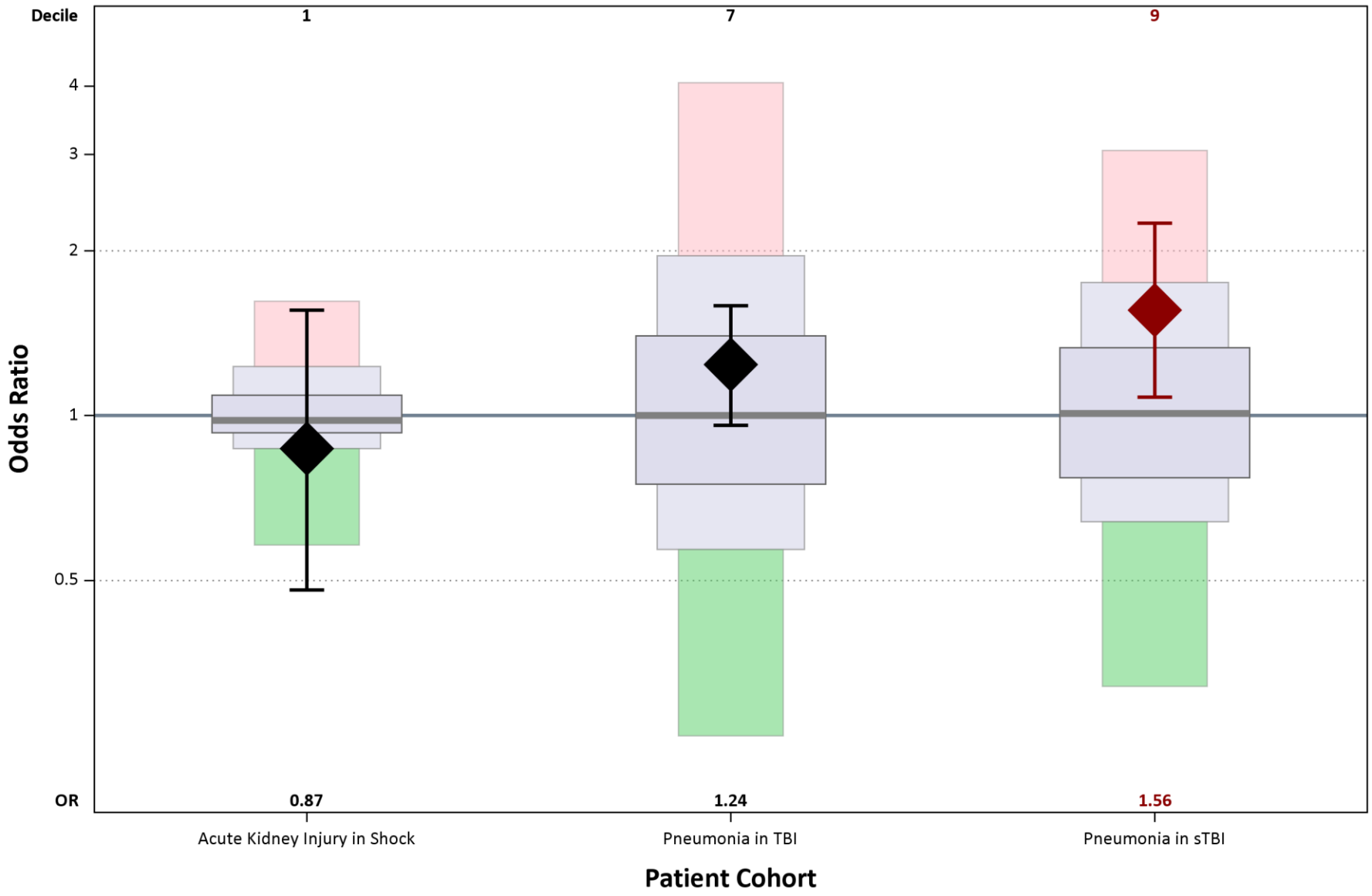
9
6
5
7
Odds Ratio
7
5
4
3
2
1
0.5
0.2
OR
1.18
1.06
1.26
1.16
1.13
1.05
1.43
1.11
0.96
1.09
All
Blunt Multisystem
Penetrating
Shock
TBI
Intubated TBI
Severe TBI
Elderly
Elderly Blunt Multisystem
IHF
Patient Cohort

Risk-Adjusted Major Complications Including Death by Cohort
TQIP Report ID: Michigan



Risk-Adjusted Major Complications Including Death by Reporting Period and Cohortt
TQIP Report ID: Michigan



Break

Back at 1:00 pm

MTQIP Data and VTE Outcomes

Anne Cain-Nielsen, MS
University of Michigan

Outcomes for low molecular weight heparin vs heparin use in MTQIP

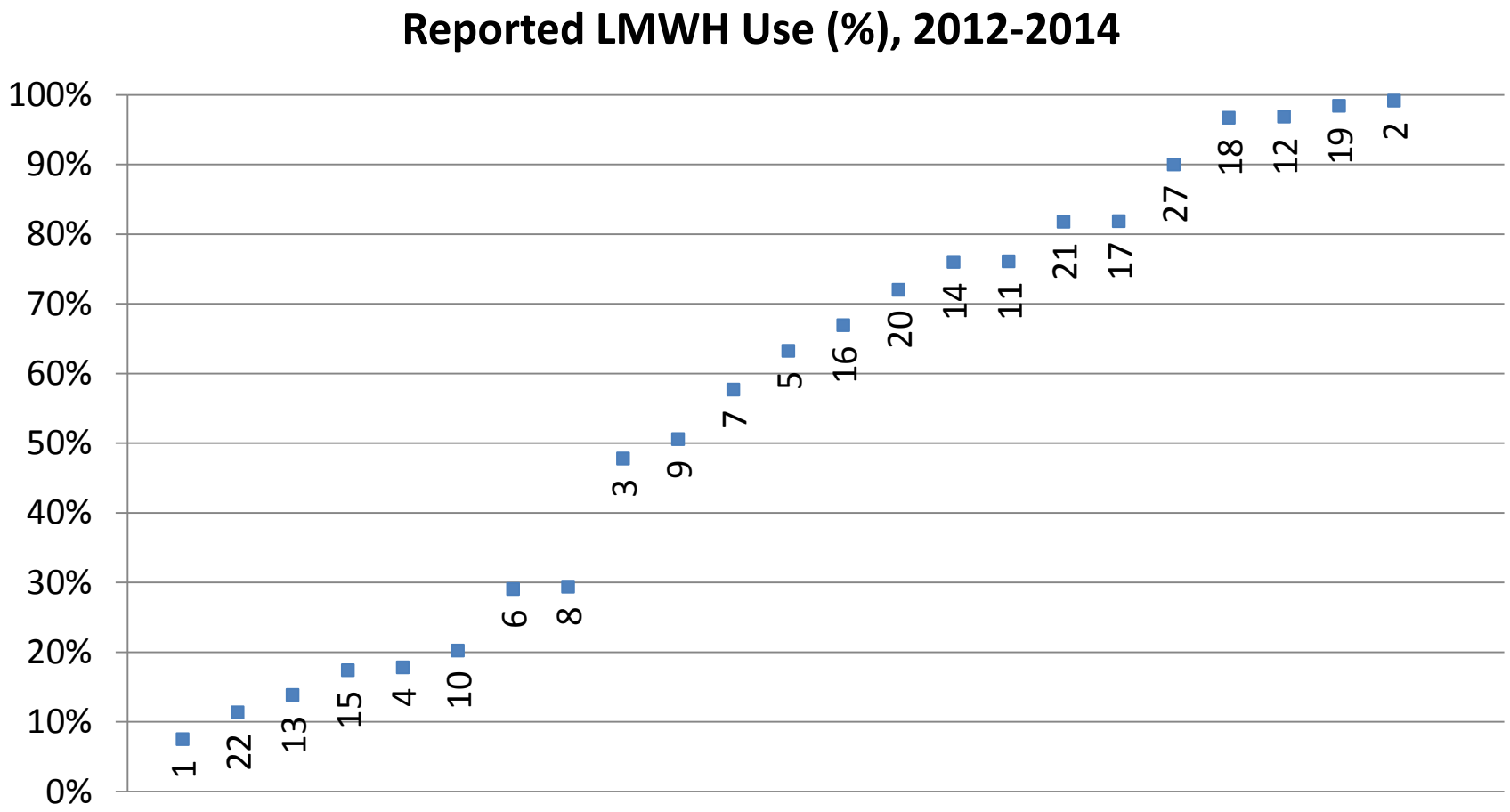
Our goals

- Compare outcomes for patients who received LMWH v heparin
  - Conflicting evidence
  - Geerts: LMWH better
  - Sise: Heparin non-inferior to LMWH
- Use regression models to figure out 'head-to-head' real world comparison
  - For similar patients who differ only by drug type, what do their VTE and mortality outcomes look like?
- We have the data to do this!

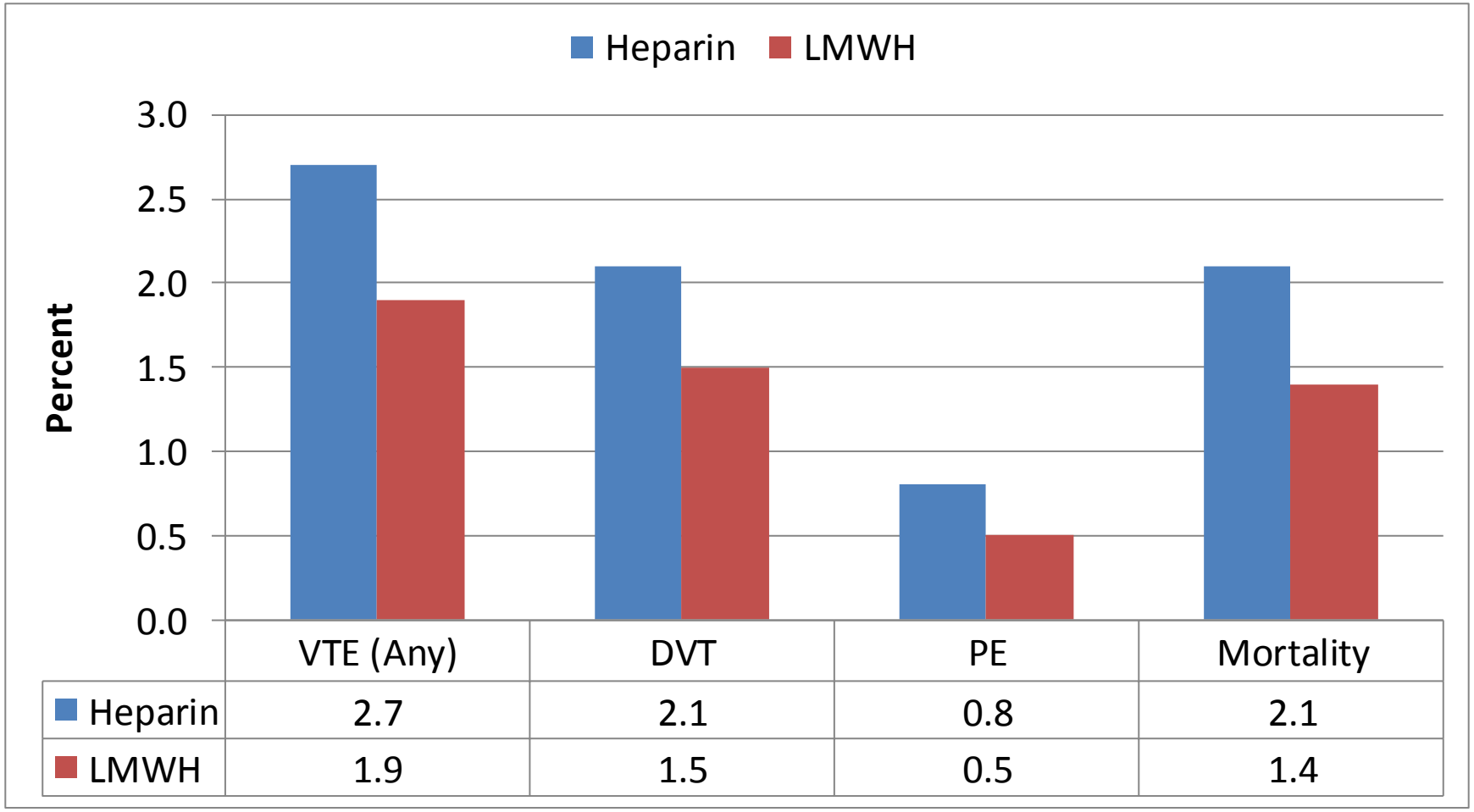
Who we studied

- Cohort 2 (Admit to trauma service, exclude DOAs and deaths within first 24h)
- Only patients who received LMWH or heparin during their hospital stay
  - Exclude other VTE prophylaxis, no VTE prophylaxis
- 18,010 patients from 2012-2014
  - 43% (7,786 patients) received heparin
  - 57% (10,224 patients) received LMWH

Hospital practices



Unadjusted Outcomes



	VTE (Any)	DVT	PE	Mortality
Heparin	2.7	2.1	0.8	2.1
LMWH	1.9	1.5	0.5	1.4

Without accounting for any patient factors, outcomes (any VTE, DVT, PE, mortality) are all better for patients who received LMWH v heparin.

Risk-adjustment

Unadjusted, LMWH looks better than Heparin. Why can't we just use these results?

- Patients who receive LMWH or heparin might be systematically different: sicker, older, etc.
- Patient differences could skew how we interpret the data

→ Use regression models to risk adjust

- Try to evaluate the effect of the drug as if we were treating the same patient.

Patient Characteristic	Heparin	LMWH	p-value
Patients, N	7,786	10,224	--
Age, Mean	51.8 ± 22.0	51.3 ± 21.6	0.09
Male Gender, %	65.6	65.1	0.5
Race, %			
White	58.8	76.6	<0.001
Black	37.4	18.1	
Other	3.8	5.3	
Private Insurance, %	46.6	52.2	<0.001
Blunt Mechanism, %	85.7	90.9	<0.001
ED Pulse, %			
51 - 120, bpm	90.8	91.5	0.002
> 120	7.3	6.5	
1 - 50	1.0	0.7	
Injury Severity Score, %			
5 - 15	74.8	73.4	<0.001
16 - 24	15.7	17.7	
25 - 35	7.8	6.8	
> 35	1.7	2.1	
AIS Head/Neck > 2, %	20.8	16.3	<0.001
AIS Face > 2, %	0.6	0.6	0.9
AIS Chest > 2, %	25.8	29.0	<0.001
AIS Abdomen > 2,%	7.8	8.1	0.4
AIS Extremity > 2, %	19.0	23.7	<0.001

Patient Characteristic	Heparin	LMWH	p-value
Intubated, %	46.5	47.5	0.2
Transfer In, %	13.4	20.9	<0.001
Acquired Coagulopathy, %	4.9	6.7	<0.001
Congestive Heart Failure, %	2.3	2.8	0.02
Dialysis	1.2	0.4	<0.001
Drug Use	13.1	11.4	<0.001
Hypertension, %	33.0	29.7	<0.001
Obesity, %	13.7	12.7	0.05
Hours to VTE Prophylaxis, Mean	35.4 ± 54.9	43.7 ± 57.6	<0.001
Hours to VTE Prophylaxis, Median	13.9	26.4	<0.001
Timely VTE Prophylaxis, %	79.6	73.8	<0.001

Data analysis

- Logistic regression
- Outcome: VTE event
- Covariates (Risk Adjusters): Age/Sex/Race, ISS, AIS, Pulse, GCS-Motor, BP, Mechanism, Comorbidities

Variable	Odds Ratio (95% CI)	*p*-value
LMWH	0.7 (0.50-0.92)	0.01
Male	1.4 (1.06-1.75)	0.02
Age		
16 - 25, years	1.0	--
26 - 45	1.5 (1.06-2.21)	0.03
46 - 65	2.3 (1.56-3.24)	<0.001
66 - 75	3.3 (2.06-5.23)	<0.001
> 75	2.5 (1.48-4.19)	0.001
Race		
White	1.0	--
Black	0.9 (0.62-1.34)	0.6
Other	0.8 (0.51-1.42)	0.5
Private Insurance	1.1 (0.85-1.39)	0.5
Injury Severity Score		
5 - 15	1.0	--
16 - 24	2.0 (1.46-2.70)	<0.001
25 - 35	2.7 (1.82-4.06)	<0.001
> 35	5.3 (3.13-8.91)	<0.001
AIS Head/Neck > 2	1.1 (0.78-1.47)	0.7
AIS Face > 2	1.0 (0.44-2.09)	0.9
AIS Chest > 2	0.9 (0.70-1.17)	0.5
AIS Abdomen	1.2 (0.83-1.61)	0.4
AIS Extremity	1.6 (1.21-1.99)	<0.001

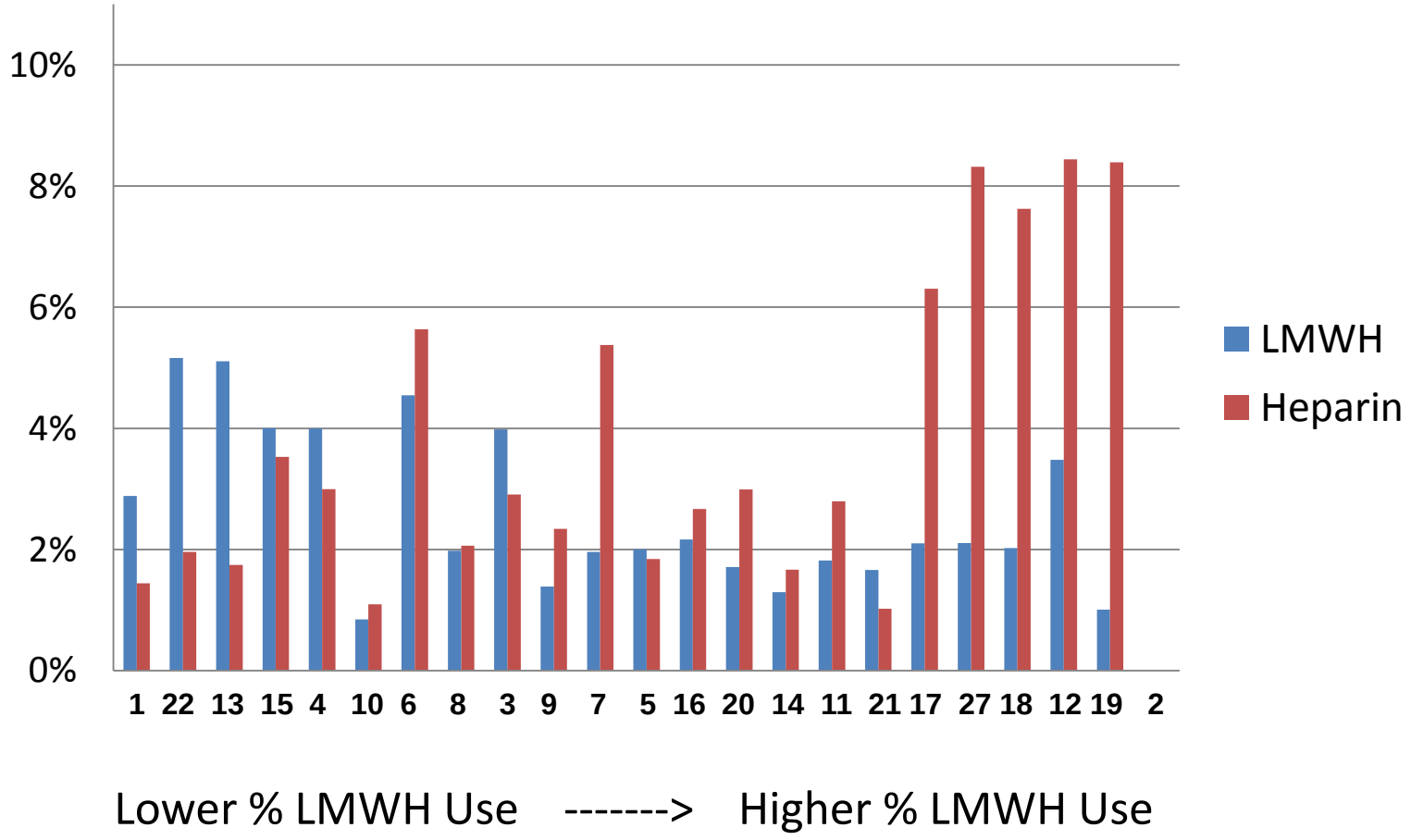
Variable	Odds Ratio (95% CI)	*p*-value
ED GCS Motor		
6	1.0	--
5 - 2	1.4 (1.04-2.02)	0.03
1	1.4 (0.95-1.95)	0.1
Blunt Mechanism	0.6 (0.44-0.90)	0.01
Fall	1.0 (0.74-1.33)	0.9
ED Systolic Blood Pressure, mmHg		
> 90	1.0	--
61 - 90	1.5 (1.00-2.17)	0.05
≤ 60	3.0 (1.41-6.49)	0.004
ED Heart Rate, bpm		
51 - 120	1.0	--
> 120	1.9 (1.38-2.48)	<0.001
1 - 50	1.0 (0.37-2.49)	0.9
Intubated	3.1 (2.16-4.33)	<0.001
Timely VTE Prophylaxis	0.4 (0.34-0.57)	<0.001
Smoking	0.8 (0.58-0.98)	0.03
Obesity	1.2 (0.94-1.64)	0.1
Acquired Coagulopathy	1.4 (0.52-3.58)	0.5
Hypertension	0.88 (0.67-1.15)	0.3
Transfer	1.1 (0.82-1.46)	0.5

More analyses

- Outcomes:
  - VTE event, plus split out into PE, DVT
  - Mortality
- Also included hospital-specific effects
- Also stratified by ISS category

Outcome	N	OR for LMWH	95% CI	p-value
VTE Event, w/o Hospital Effect	18,010	**0.65**	0.52-0.81	<0.001
VTE Event, with Hospital Effect	17,895	**0.67**	0.50-0.92	0.01
VTE Event by ISS categories				
5-15	13,241	**0.51**	0.30-0.87	0.01
16-24	2,945	**0.45**	0.15-0.81	0.008
≥ 25	1,570	**1.12**	0.66-1.89	0.7
PE, w/o Hospital Effect	18,010	**0.52**	0.35-0.78	0.002
PE, with Hospital Effect	17,895	**0.42**	0.23-0.77	0.005
PE by ISS categories				
5-15	11,749	**0.24**	0.09-0.62	0.003
16-24	1,999	**0.46**	0.14-1.54	0.2
≥ 25	1,228	**0.73**	0.22-2.47	0.6
DVT, w/o Hospital Effect	18,010	**0.70**	0.54-0.90	0.005
DVT, with Hospital Effect	17,895	**0.78**	0.56-1.08	0.14
DVT by ISS categories				
5-15	12,869	**0.61**	0.33-1.13	0.11
16-24	2,945	**0.49**	0.26-0.92	0.03
≥ 25	1,560	**1.31**	0.76-2.30	0.3
Mortality, w/o Hospital Effect	18,010	**0.64**	0.50-0.83	0.001
Mortality, with Hospital Effect	18,010	**0.57**	0.41-0.79	0.001
Mortality by ISS categories				
5-15	13,328	**0.61**	0.38-0.97	0.04
16-24	2,820	**0.67**	0.29-1.54	0.3
≥ 25	1,611	**0.50**	0.26-0.94	0.03

Hospital-level analysis: Risk-Adjusted VTE event rates for LMWH vs heparin patients



Conclusions

- Overall, protective effects of LMWH
  - For VTE event and mortality
  - Tends to be more noticeable in lower ISS patients

- Also seems to be ‘hospital effect’
  - In most hospitals, VTE event rates better for LMWH vs heparin – except those hospitals that use mostly heparin.

VTE

Elliott Haut, MD
Johns Hopkins University

Venous Thromboembolism Prevention in Trauma: Can We Do Better?

Elliott R. Haut, MD, PhD, FACS
Associate Professor of Surgery &
Anesthesiology / Critical Care Medicine &
Emergency Medicine & Health Policy / Management

@elliotthaut

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Why focus on VTE?

- VTE is common
  - 350,000 to 600,000 Americans suffer DVT and/or PE each year

http://www.surgeongeneral.gov/topics/deepvein/calltoaction/call-to-action-on-dvt-2008.pdf

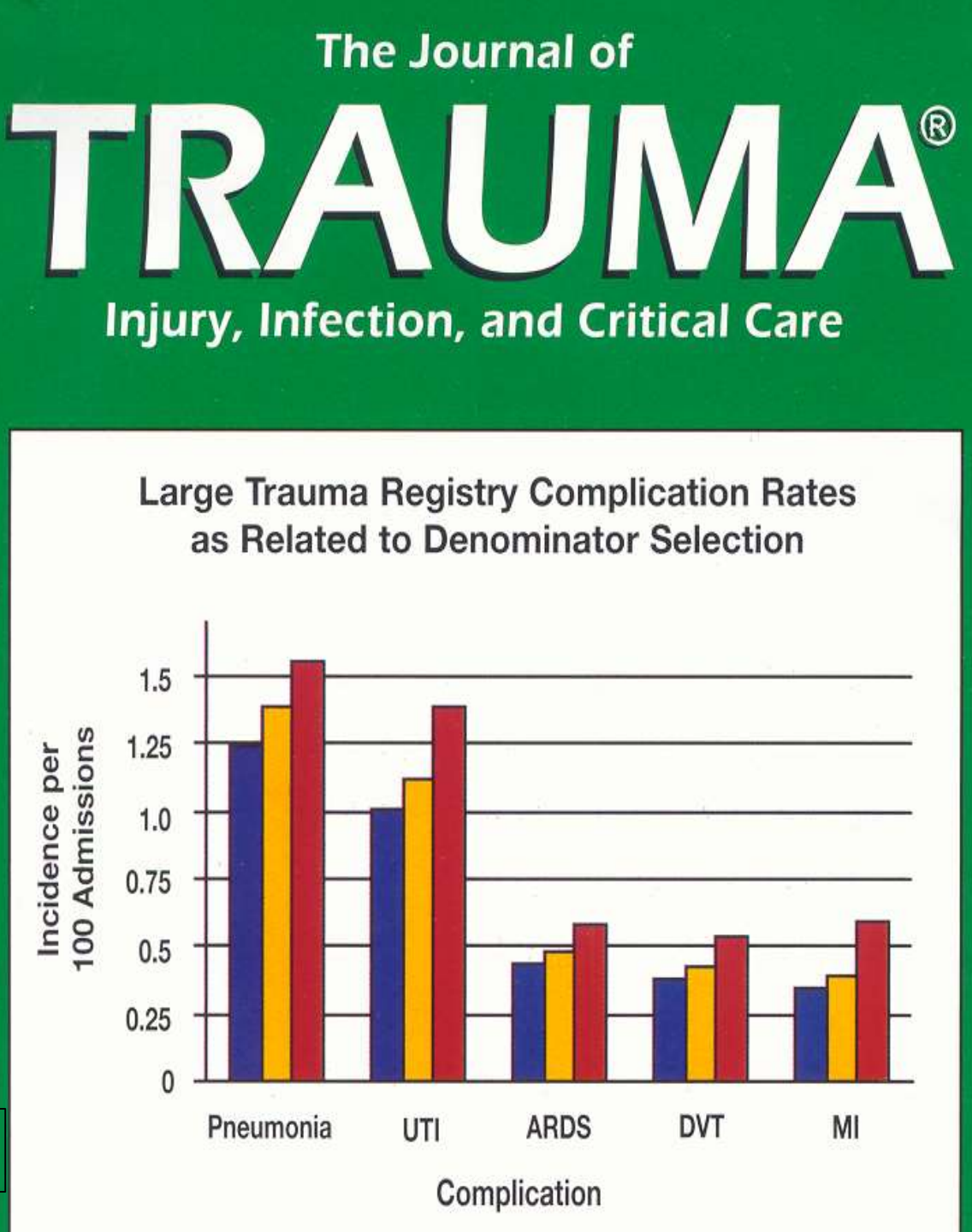
Why focus on VTE?

- VTE is Deadly
  - >100,000 deaths per year
- More deaths than combined from
  - Breast Cancer
  - Motor Vehicle Collisions
  - AIDS

http://www.surgeongeneral.gov/topics/deepvein/calltoaction/call-to-action-on-dvt-2008.pdf

DVT is 4th most commonly reported complication in Trauma Patients

Kardooni, J Trauma 2008



DVT Incidence After Trauma

- DVT rates reported as high as 58% of moderately to severely injured patients (ISS>=9)
- Rates lower in broader trauma populations
    - 0.36% in overall NTDB (Knudson)
    - 0.38%-0.54% in NTDB (Kardooni)

Geerts, NEJM 1994
Knudson, Ann Surg 2004
Kardooni, J Trauma 2008

Why focus on VTE?

- VTE is (mostly) preventable

VTE Should NOT be Considered a "Never Event"

- Not ALL events are preventable
- VTE occurs even in patients receiving best practice prophylaxis
- 8 RCTs of VTE Prophylaxis in Joint Replacement Surgery (4 TKA, 4 THR)
  - 0.3%-2.5% Symptomatic VTE

Streiff & Haut, JAMA 2009

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Evidence Based
VTE Prophylaxis Guidelines

- American College of Chest Physicians (ACCP)

- Eastern Association for the Surgery of Trauma (EAST)
- American Academy of Orthopedic Surgeons (AAOS)
- American College of Obstetricians and Gynecologists (ACOG)
- American College of Physicians (ACP)

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Brief Summary of Evidence Based Prophylaxis Guidelines in Trauma

- American College of Chest Physicians (ACCP)
- Eastern Association for the Surgery of Trauma (EAST)

- **Give LMWH- (Enoxaparin 30mg q12)**
- If LMWH contraindicated- use mechanical
  - Sequential Compression Devices (SCDs)

Geerts, CHEST 2008
http://www.east.org/tpg/dvt.pdf

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DVT Prophylaxis is Vastly Underutilized!

A Prospective Registry of 5,451 Patients With Ultrasound-Confirmed Deep Vein Thrombosis

Samuel Z. Goldhaber, MD, and Victor F. Tapson, MD, for the DVT FREE Steering Committee*

We enrolled 5,451 patients with ultrasound-confirmed deep vein thrombosis (DVT), including 2,892 women and 2,559 men, from 183 United States sites in our prospective registry. The 5 most frequent comorbidities were hypertension (50%), surgery within 3 months (38%), immobility within 30 days (34%), cancer (32%), and obesity (27%). Of the 2,726 patients who had their DVT diagnosed while in the hospital, only 1,147 (42%) received prophylaxis within 30 days before diagnosis.

(Am J Cardiol 2004;93:259–262)

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Venous thromboembolism risk and prophylaxis in the acute hospital care setting (ENDORSE study): a multinational cross-sectional study

*Alexander T Cohen, Victor F Tapson, Jean-Francois Bergmann, Samuel Z Goldhaber, Ajay K Kakkar, Bruno Deslandes, Wei Huang, Maksim Zayaruzny, Leigh Emery, Frederick A Anderson Jr, for the ENDORSE Investigators**

- 68,183 patients
- 358 hospitals in 32 countries
- Prophylaxis
  - 58.5 % compliance - surgical patients
  - 39.5 % compliance - medical patients

Cohen, Lancet 2008

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"The disconnect between evidence and execution as it relates to DVT prevention amounts to a public health crisis."

Samuel Z. Goldhaber, M.D.,
Associate Professor
of Medicine,
Harvard Medical School

DEEP-VEIN THROMBOSIS: ADVANCING AWARENESS TO PROTECT PATIENT LIVES

White Paper
Public Health Leadership Conference on Deep-Vein Thrombosis
Washington, D.C. • February 26, 2003

American Public Health Association

DVT: Advancing Awareness to Protect Patient Lives

American Public Health Association (APHA)
White Paper 2003

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Agency for Healthcare Research and Quality (AHRQ)

Deep vein thrombosis (DVT)-related pulmonary embolism (PE) is the most common cause of preventable hospital death[1]

DVT prophylaxis of at-risk patients is the #1 strategy to improve patient safety in hospitals[1]

www.ahrq.gov

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Making Health Care Safer II: An Updated Critical Analysis of the Evidence for Patient Safety Practices

AHRQ
Agency for Healthcare Research and Quality
Advancing Excellence in Health Care • www.ahrq.gov

Evidence-Based Practice

Patient Safety

Table C. Strongly encouraged patient safety practices

- Preoperative checklists and anesthesia checklists to prevent operative and post-operative events
- Bundles that include checklists to prevent central line-associated bloodstream infections
- Interventions to reduce urinary catheter use, including catheter reminders, stop orders, or nurse-initiated removal protocols
- Bundles that include head-of-bed elevation, sedation vacations, oral care with chlorhexidine, and subglottic-suctioning endotracheal tubes to prevent ventilator-associated pneumonia
- Hand hygiene
- "Do Not Use" list for hazardous abbreviations
- Multicomponent interventions to reduce pressure ulcers
- Barrier precautions to prevent healthcare-associated infections
- Use of real-time ultrasound for central line placement
- Interventions to improve prophylaxis for venous thromboembolisms

http://www.ahrq.gov/research/findings/evidence-based-reports/services/quality/ptsafetysum.pdf

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Making Health Care Safer II: An Updated Critical Analysis of the Evidence for Patient Safety Practices

AHRQ
Agency for Healthcare Research and Quality
Advancing Excellence in Health Care • www.ahrq.gov

Evidence-Based Practice

Patient Safety

Chapter 28. Prevention of Venous Thromboembolism: Brief Update Review

Elliott R. Haut, M.D., FACS; Brandyn D. Lau, M.P.H.

- "Strategies to increase appropriate prophylaxis for VTE" included on list of top 10 "Strongly Encouraged Patient Safety Practices"

http://www.ahrq.gov/research/findings/evidence-based-reports/patientsftyupdate/ptsafetyIIchap28.pdf

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Surveillance Bias and Public Reporting of VTE

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How did I get interested in VTE?

- Adult Trauma Performance Improvement
- Paraphrased letter we received
- Dear Johns Hopkins Adult Trauma
- You have the highest DVT rate of all Trauma Centers in Maryland
- Why?
- Sincerely, Maryland Institute for Emergency Medical Services Systems (MIEMSS)

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A New Research Idea is Born

- Johns Hopkins screens aggressively
- What do other trauma centers do?
- Does this impact reported DVT rates?

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Conflict Regarding Duplex Screening for asymptomatic DVT

- Conflicting data on efficacy and cost-effectiveness of duplex screening of asymptomatic trauma patients

- *Pro:* Identify DVT early allowing treatment before fatal PE
- *Con:* Large expense, not cost effective, harm from anticoagulation

Should we Screen High-Risk Trauma Patients for DVT?

Conflicting Guidelines

VS.

Rogers, J Trauma 2002
Gould, CHEST 2012

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Eastern Association for the Surgery of Trauma (EAST) Guideline

- "Serial duplex ultrasound imaging of high-risk asymptomatic trauma patients to screen for DVT may be cost-effective and decrease the incidence of PE."

http://www.EAST.org/resources/treatment-guidelines
Rogers, J Trauma 2002

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American College of Chest Physicians (ACCP) Guidelines

- "For major trauma patients, we suggest that periodic surveillance with venous compression ultrasonography should not be performed (Grade 2C)."

Gould, CHEST 2012

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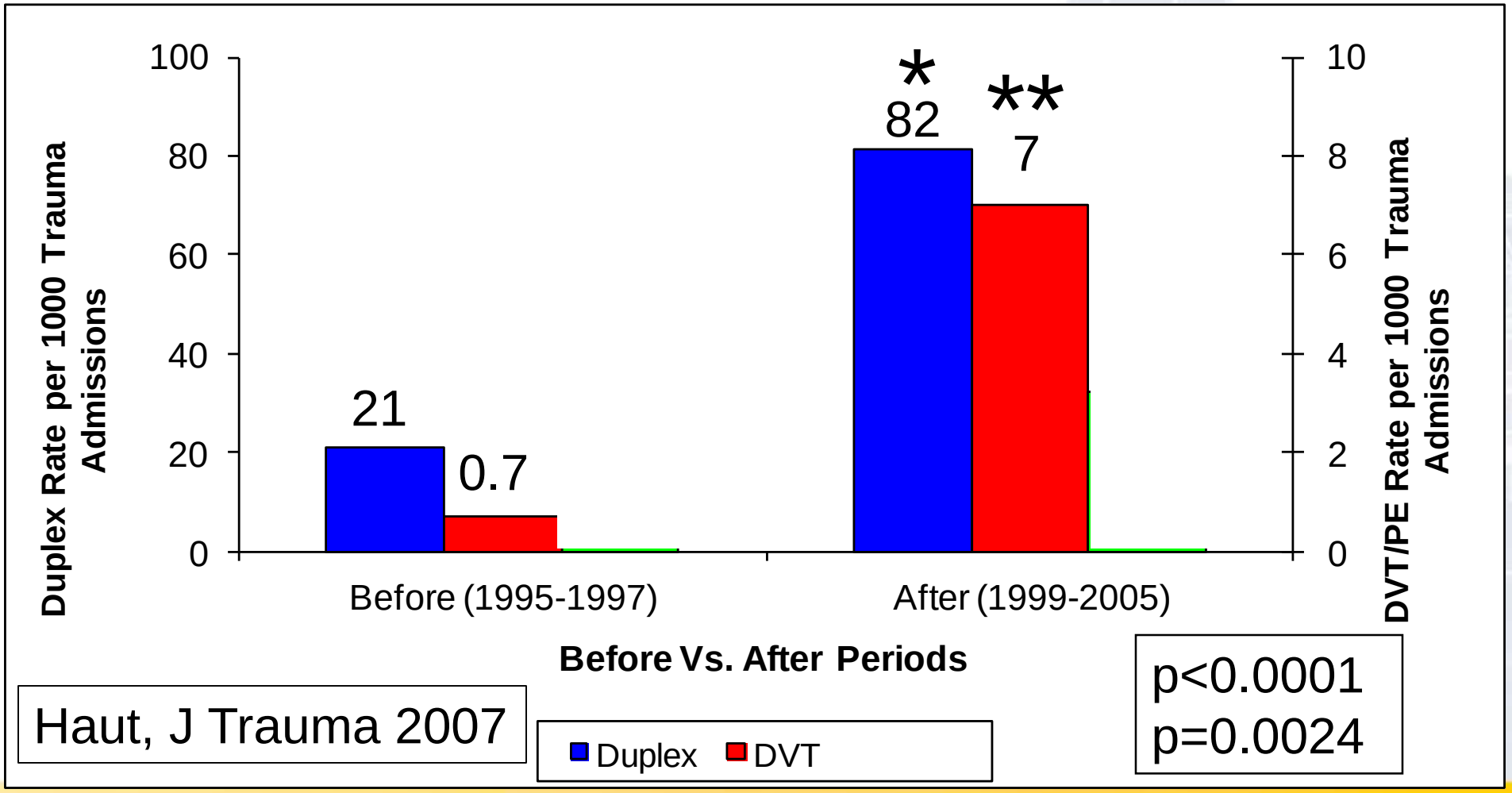
Single Center (JHH)- Duplex & DVT rates Before v. After Screening Guideline



Multi-Center (NTDB)- Hospital Level Duplex & DVT rates

- Trauma centers with higher rates of duplex ultrasound report higher DVT rates to the National Trauma Data Bank

The Journal of **TRAUMA**® *Injury, Infection, and Critical Care*

Surveillance Bias and Deep Vein Thrombosis in the National Trauma Data Bank: The More We Look, The More We Find

Charles A. Pierce, MPH, Elliott R. Haut, MD, Shahrzad Kardooni, MPH, David C. Chang, MBA, MPH, PhD, David T. Efron, MD, Adil Haider, MD, MPH, Peter J. Pronovost, MD, PhD, and Edward E. Cornwell III, MD

Pierce, J Trauma 2008

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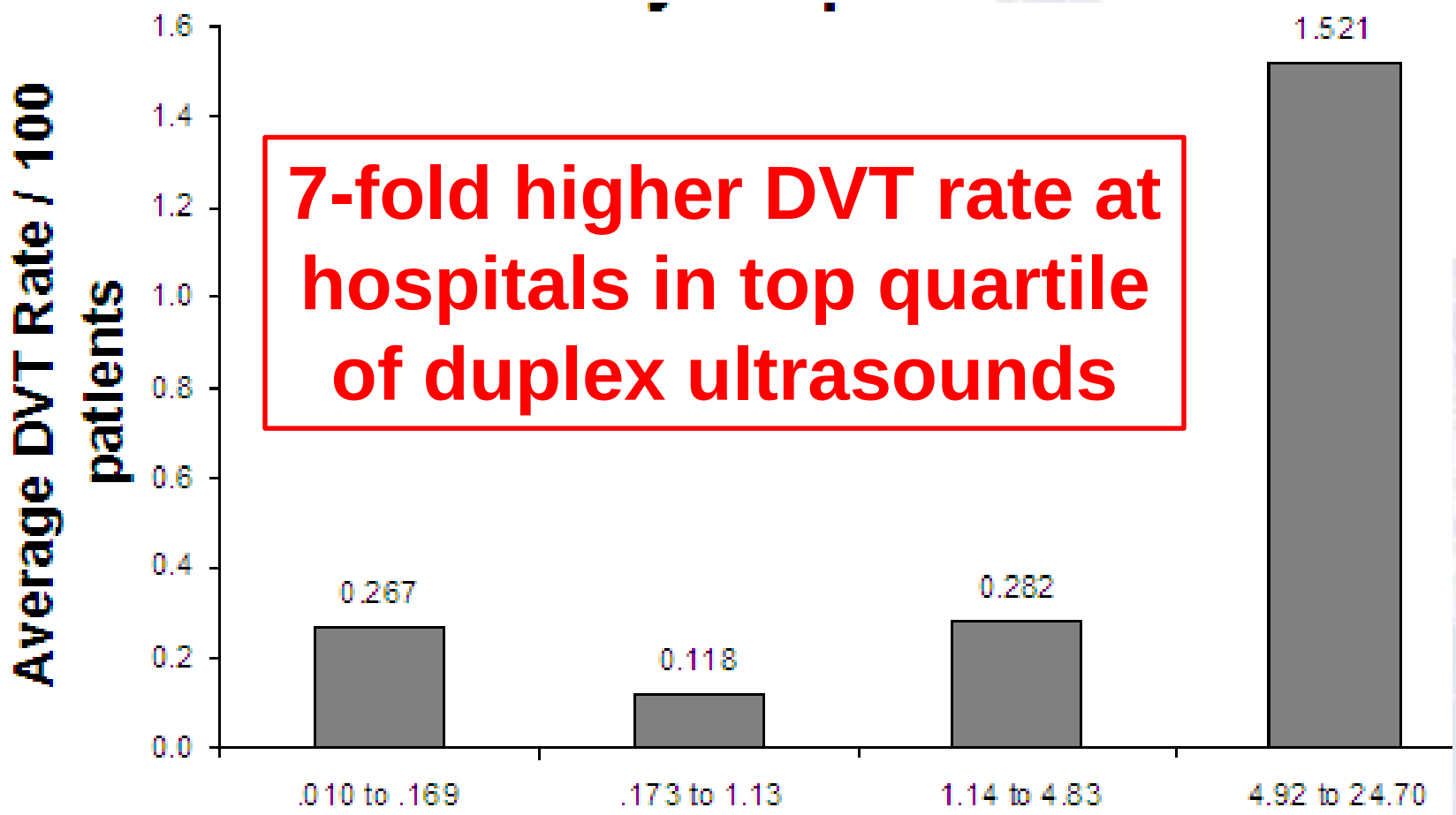
The More We Look, The More We Find

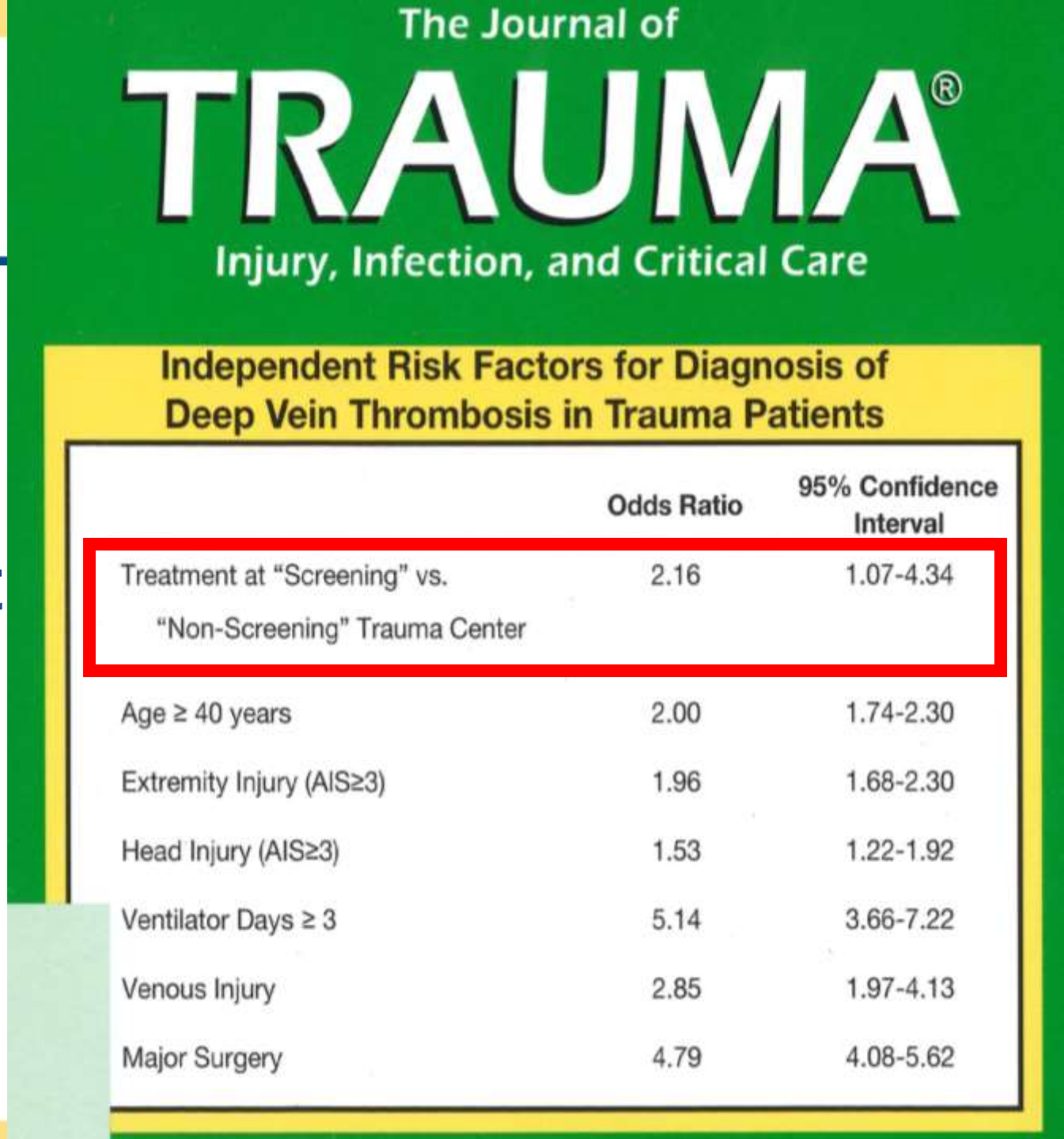


7-fold higher DVT rate at hospitals in top quartile of duplex ultrasounds

Pierce, J Trauma 2008

Hospital Screening Status is an Independent Risk Factor for DVT Reporting

Haut,
J Trauma 2009

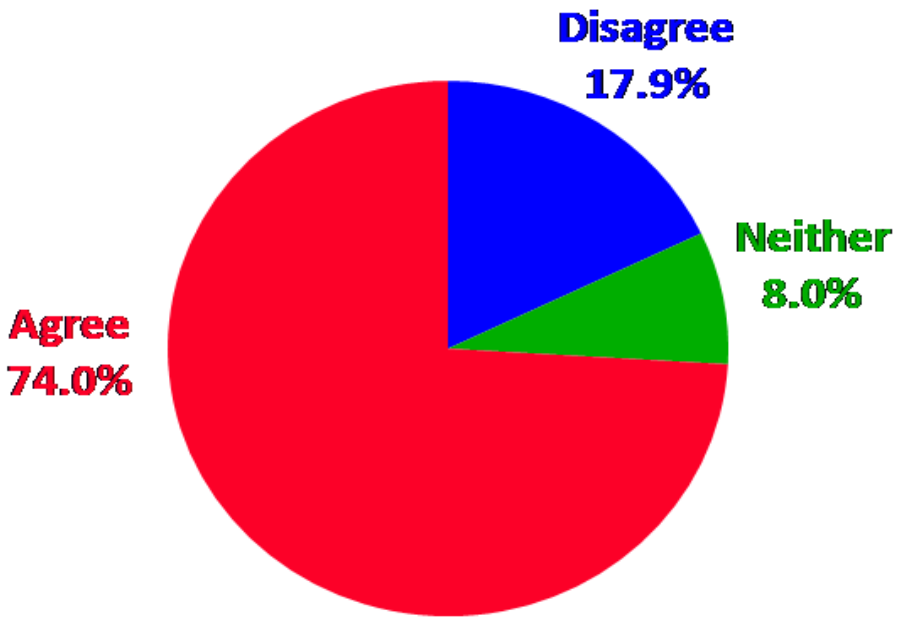


Independent Risk Factors for Diagnosis of Deep Vein Thrombosis in Trauma Patients

	Odds Ratio	95% Confidence Interval
Treatment at "Screening" vs. "Non-Screening" Trauma Center	2.16	1.07-4.34
Age ≥ 40 years	2.00	1.74-2.30
Extremity Injury (AIS≥3)	1.96	1.68-2.30
Head Injury (AIS≥3)	1.53	1.22-1.92
Ventilator Days ≥ 3	5.14	3.66-7.22
Venous Injury	2.85	1.97-4.13
Major Surgery	4.79	4.08-5.62

Variability in Trauma Surgeons Opinions of DVT Screening

- AAST/EAST member survey
- 317 individual trauma surgeons



"High risk asymptomatic patients should be screened for DVT"

Haut, J Trauma 2011

A Classic Example of Surveillance Bias

- Providers who screen more aggressively by performing more duplex ultrasounds may identify more cases of DVT and appear to provide worse quality of care than those providers who order fewer tests

Haut & Pronovost, JAMA 2011

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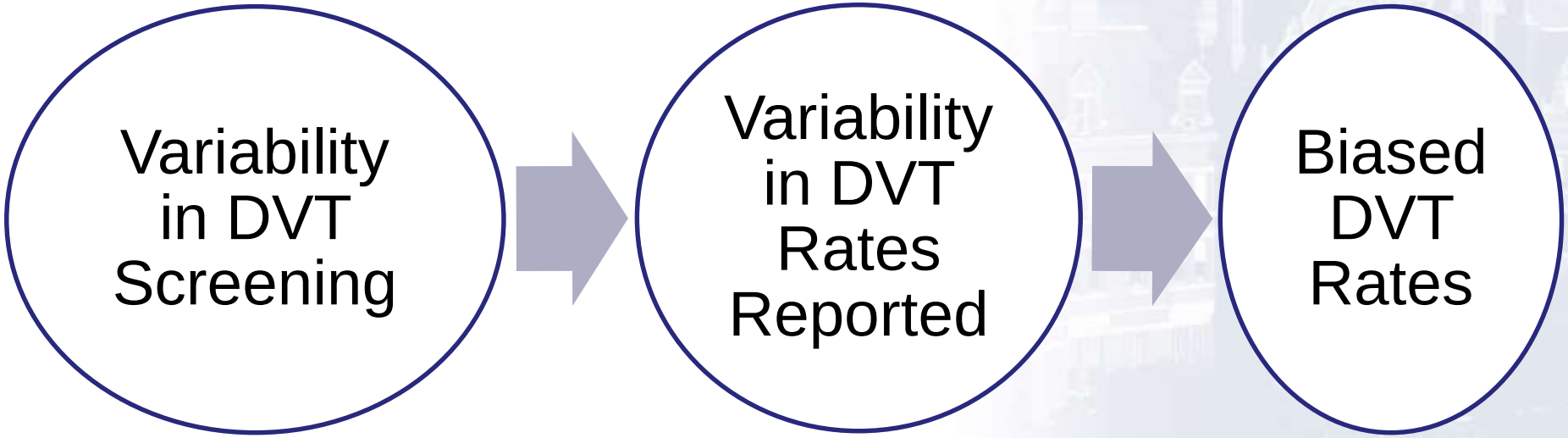
Implications

Surveillance Bias in Outcomes Reporting

Elliott R. Haut, MD
Peter J. Pronovost, MD, PhD

DVT, some clinicians use duplex ultrasound to screen high-risk asymptomatic trauma patients for DVT. Other clinicians argue this approach is neither clinically necessary nor



Haut & Pronovost, JAMA 2011

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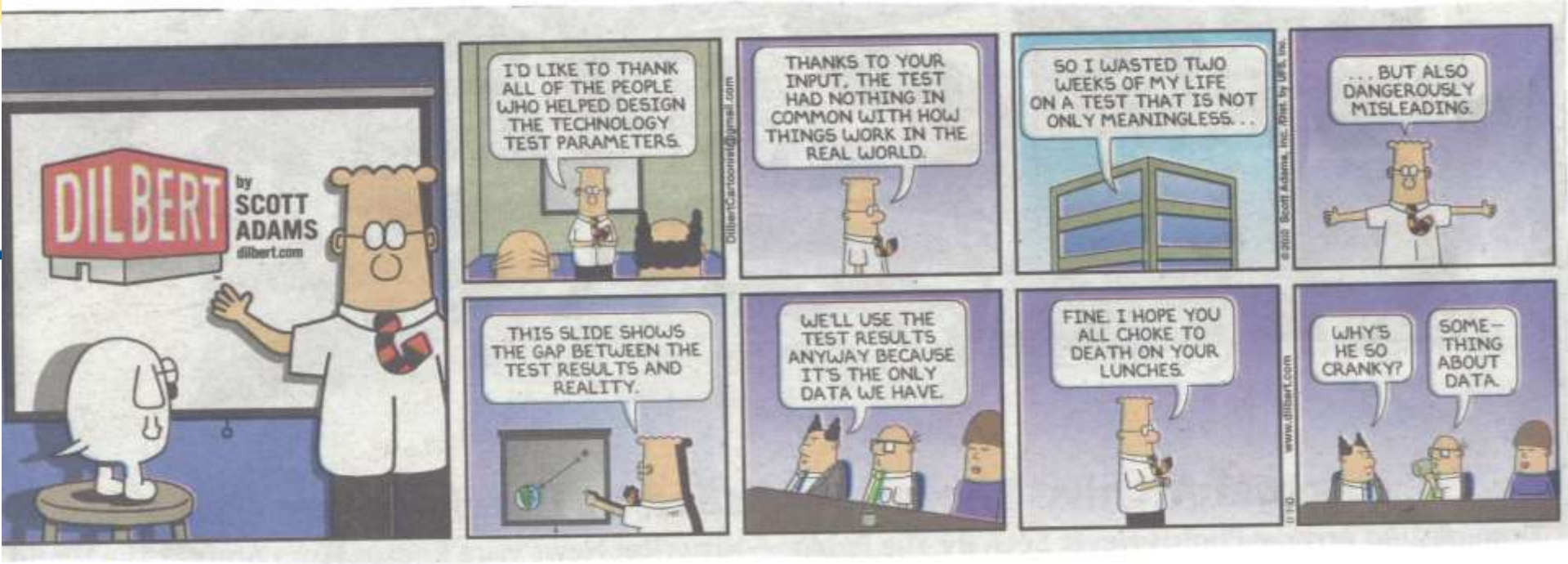

"We'll just use the test results anyway because it's the only data we have"

http://dilbert.com/strips/comic/2010-11-07

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Defining Preventable Harm
The VTE Example

- We suggested that "performance measures could link a process of care with adverse outcomes when defining incidences of preventable harm"

Preventable Harm =
VTE + No Prophylaxis

Haut & Pronovost, JAMA 2011

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We Talked

- Centers for Medicare & Medicaid Services listened

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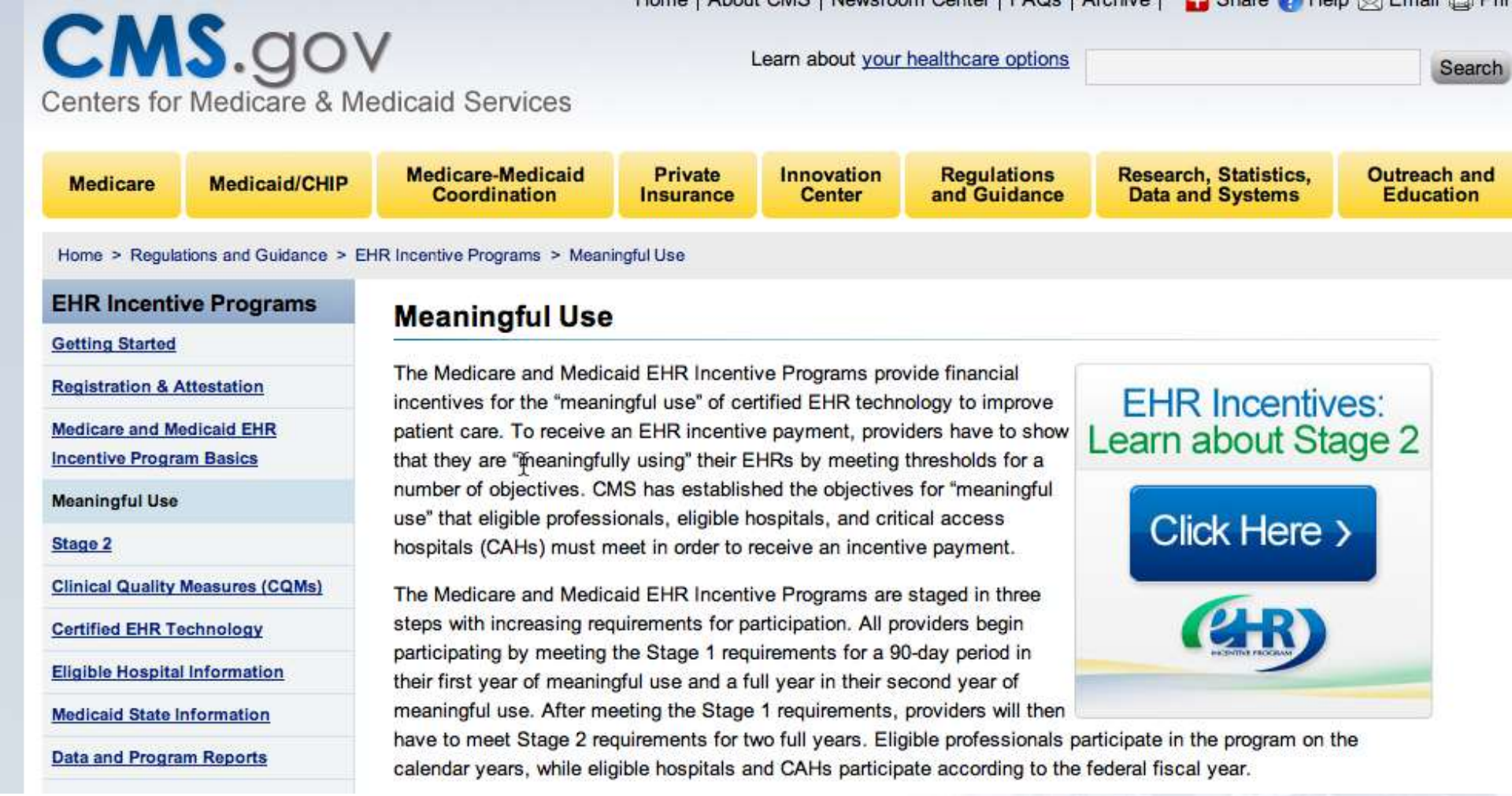

- Financial incentives for the "meaningful use" of certified EHR technology to improve patient care

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"Meaningful Use" Quality Reporting Criteria Related to VTE

- "Meaningful Use" of Electronic Health Record (EHR) Technology
  - VTE1 Prophylaxis within 24 hours of arrival
  - VTE2 ICU VTE Prophylaxis
  - VTE3 Anticoagulation Overlap Therapy
  - VTE4 Platelet Monitoring on UFH
  - VTE5 VTE Discharge Instructions
  - VTE6 Incidence of Potentially Preventable VTE

https://www.cms.gov/EHRIncentivePrograms/30_Meaningful_Use.asp

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"Meaningful Use" Definition of Potentially Preventable VTE

- VTE-6 Incidence of Potentially Preventable VTE
- "This measure assesses the number of patients diagnosed with confirmed VTE during hospitalization (not present or suspected at admission) who did not receive VTE prophylaxis between hospital admission and the day before the VTE diagnostic testing order date."

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Surveillance Bias in VTE Reporting in Surgery

Original Investigation

Evaluation of Surveillance Bias and the Validity of the Venous Thromboembolism Quality Measure

Karl Y. Bilimoria, MD, MS; Jeanette Chung, PhD; Mila H. Ju, MD; Elliott R. Haut, MD; David J. Bentrem, MD, MS; Clifford Y. Ko, MD, MS; David W. Baker, MD, MPH

JAMA. doi:10.1001/jama.2013.280048
Published online October 7, 2013.

Bilimoria, JAMA 2013

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Surveillance Bias in VTE Reporting in Surgery

- 2,786 hospitals
- 954,526 Medicare patients >=65 years
- 11 major operations
  - AAA, CABG, craniotomy, colectomy, cystectomy, esophagectomy, gastric bypass, lung resection, pancreatic resection, proctectomy, total knee arthroplasty

Bilimoria, JAMA 2013

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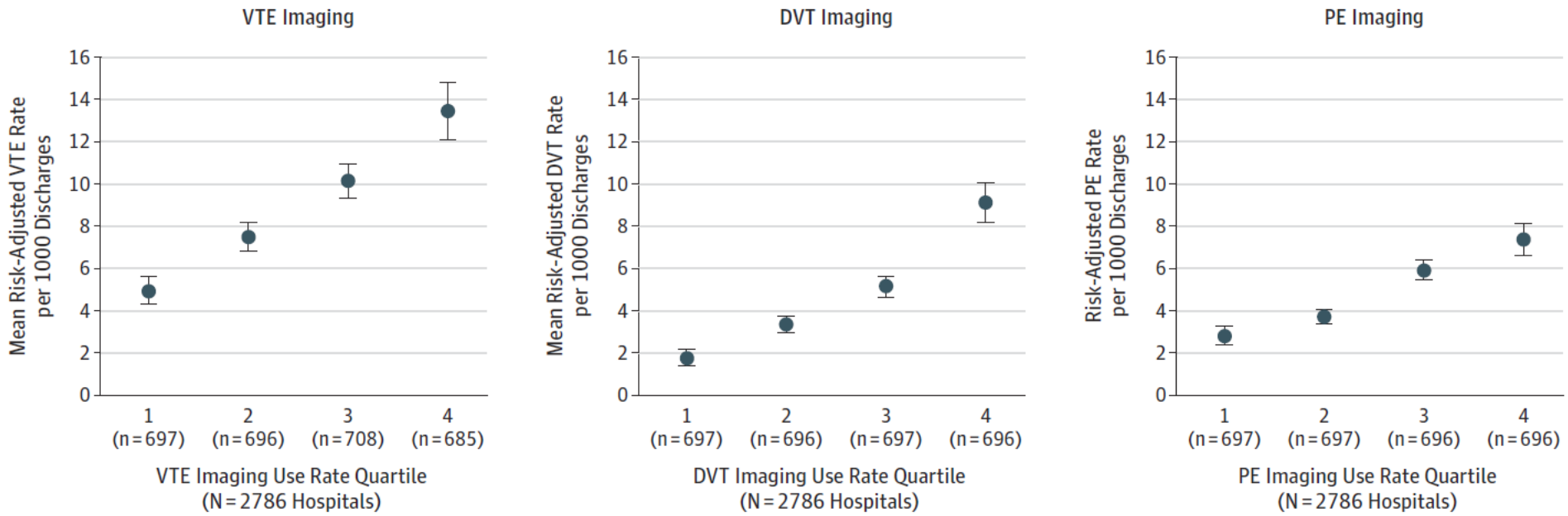
Surveillance Bias in VTE Reporting in Surgery

Figure 3. Mean Risk-Adjusted Event Rates by Imaging Use Rate Quartile



Bilimoria, JAMA 2013

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Can a Systems Approach Improve VTE Prevention and Outcomes

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What approaches can improve VTE prophylaxis ?

- “Passive dissemination of guidelines is unlikely to improve VTE prophylaxis practice.”
- “A number of active strategies used together, which incorporate some method for reminding clinicians to assess patients for DVT risk and assisting the selection of appropriate prophylaxis, are likely to result in the achievement of optimal outcomes.”

Tooher, A Systematic Review of Strategies to Improve Prophylaxis for Venous Thromboembolism in Hospitals. Ann Surg 2005.

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Improving VTE Prophylaxis at The Johns Hopkins Hospital

Lessons from the Johns Hopkins Multi-Disciplinary Venous Thromboembolism (VTE) Prevention Collaborative

BMJ 2012;344:e3935

Michael B Streiff *associate professor of medicine*[1 2], Howard T Carolan *quality and innovations project administrator*[3], Deborah B Hobson *patient safety clinical specialist, surgical intensive care nurse and coordinator*[3 4], Peggy S Kraus *clinical specialist for anticoagulation*[5], Christine G Holzmueller *senior research coordinator II, medical writer and editor*[3 6], Renee Demski *senior director, quality and safety*[3], Brandyn D Lau *medical informatician*[7], Paula Biscup-Horn *clinical pharmacy specialist, anticoagulation management*[8], Peter J Pronovost *professor, director, senior vice president for patient safety and quality*[6 3 9 10], Elliott R Haut *associate professor of surgery*[3 4 6 9 11]

Streiff, BMJ 2012

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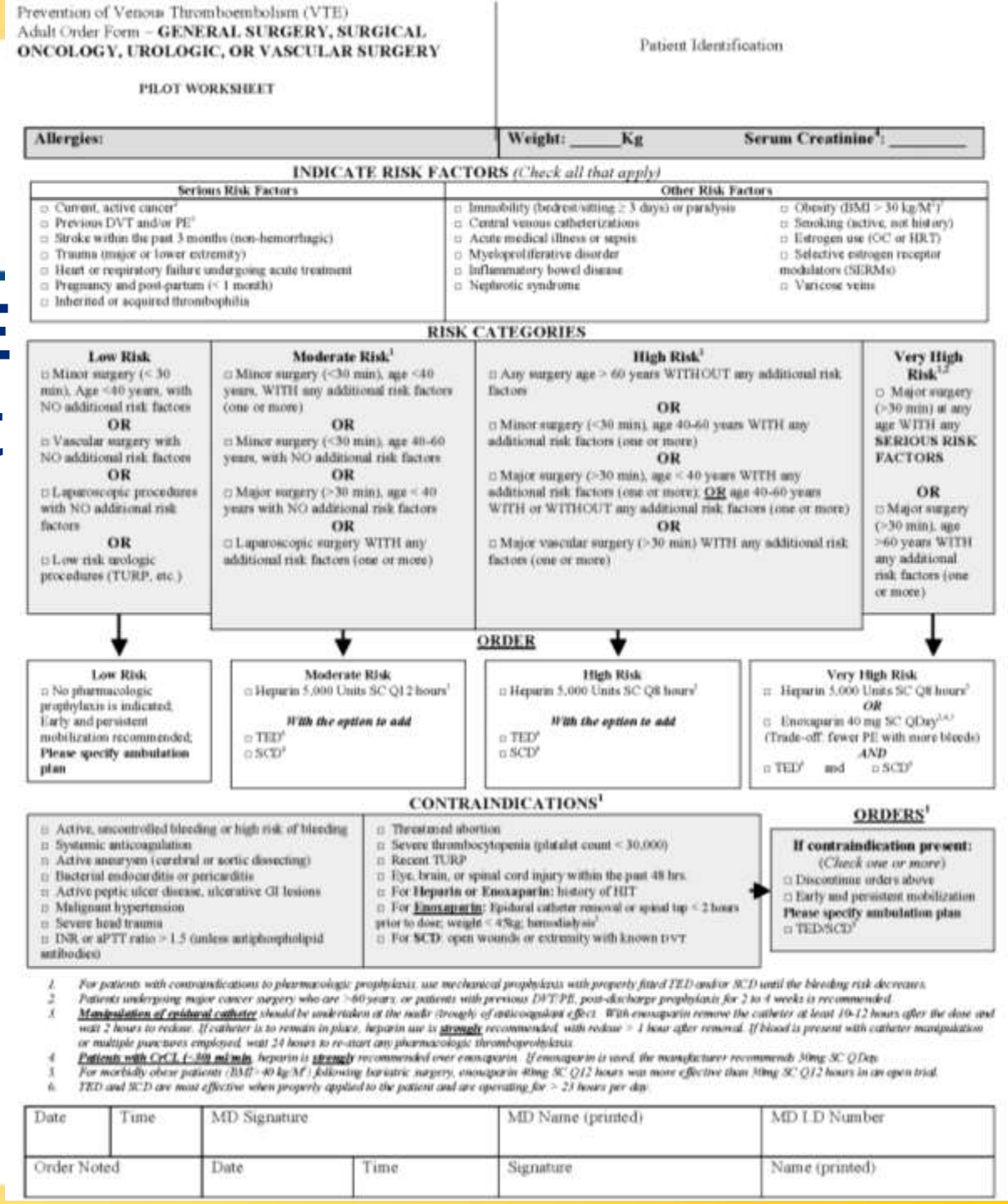
Improving VTE Prophylaxis at The Johns Hopkins Hospital

Paper Order Sets

Streiff, BMJ 2012



Prevention of Venous Thromboembolism (VTE)
Adult Order Form – **GENERAL SURGERY, SURGICAL ONCOLOGY, UROLOGIC, OR VASCULAR SURGERY**

PILOT WORKSHEET

Patient Identification

Allergies: | **Weight:** _____Kg | **Serum Creatinine**[1]: _____

INDICATE RISK FACTORS *(Check all that apply)*

Serious Risk Factors
- Current, active cancer[2]
- Previous DVT and/or PE[3]
- Stroke within the past 3 months (non-hemorrhagic)
- Trauma (major or lower extremity)
- Heart or respiratory failure undergoing acute treatment
- Pregnancy and post-partum (< 1 month)
- Inherited or acquired thrombophilia

Other Risk Factors
- Immobility (bedrest/sitting ≥ 3 days) or paralysis
- Central venous catheterizations
- Acute medical illness or sepsis
- Myeloproliferative disorder
- Inflammatory bowel disease
- Nephrotic syndrome
- Obesity (BMI > 30 kg/M²)[4]
- Smoking (active, not history)
- Estrogen use (OC or HRT)
- Selective estrogen receptor modulators (SERMs)
- Varicose veins

RISK CATEGORIES

Low Risk
- Minor surgery (< 30 min), Age <40 years, with NO additional risk factors

OR
- Vascular surgery with NO additional risk factors

OR
- Laparoscopic procedures with NO additional risk factors

OR
- Low risk urologic procedures (TURP, etc.)

Moderate Risk[1]
- Minor surgery (<30 min), age <40 years, WITH any additional risk factors (one or more)

OR
- Minor surgery (<30 min), age 40-60 years, with NO additional risk factors

OR
- Major surgery (>30 min), age < 40 years with NO additional risk factors

OR
- Laparoscopic surgery WITH any additional risk factors (one or more)

High Risk[1]
- Any surgery age > 60 years WITHOUT any additional risk factors

OR
- Minor surgery (<30 min), age 40-60 years WITH any additional risk factors (one or more)

OR
- Major surgery (>30 min), age < 40 years WITH any additional risk factors (one or more); OR age 40-60 years WITH or WITHOUT any additional risk factors (one or more)

OR
- Major vascular surgery (>30 min) WITH any additional risk factors (one or more)

Very High Risk[1,2]
- Major surgery (>30 min) at any age WITH any **SERIOUS RISK FACTORS**

OR
- Major surgery (>30 min), age >60 years WITH any additional risk factors (one or more)

ORDER

Low Risk
- No pharmacologic prophylaxis is indicated; Early and persistent mobilization recommended; **Please specify ambulation plan**

Moderate Risk
- Heparin 5,000 Units SC Q12 hours[1]

With the option to add
- TED[5]
- SCD[5]

High Risk
- Heparin 5,000 Units SC Q8 hours[1]

With the option to add
- TED[5]
- SCD[5]

Very High Risk
- Heparin 5,000 Units SC Q8 hours[1]

OR
- Enoxaparin 40 mg SC QDay[1,6,7] (Trade-off: fewer PE with more bleeds)

AND
- TED[5] and SCD[5]

CONTRAINDICATIONS[1]
- Active, uncontrolled bleeding or high risk of bleeding
- Systemic anticoagulation
- Active aneurysm (cerebral or aortic dissecting)
- Bacterial endocarditis or pericarditis
- Active peptic ulcer disease, ulcerative GI lesions
- Malignant hypertension
- Severe head trauma
- INR or aPTT ratio > 1.5 (unless antiphospholipid antibodies)
- Threatened abortion
- Severe thrombocytopenia (platelet count < 30,000)
- Recent TURP
- Eye, brain, or spinal cord injury within the past 48 hrs.
- For **Heparin or Enoxaparin:** history of HIT
- For **Enoxaparin:** Epidural catheter removal or spinal tap < 2 hours prior to dose; weight < 45kg; hemodialysis[1]
- For **SCD:** open wounds or extremity with known DVT

ORDERS[1]

If contraindication present: *(Check one or more)*
- Discontinue orders above
- Early and persistent mobilization

Please specify ambulation plan
- TED/SCD[5]

1. *For patients with contraindications to pharmacologic prophylaxis, use mechanical prophylaxis with properly fitted TED and/or SCD until the bleeding risk decreases.*
2. *Patients undergoing major cancer surgery who are >60 years, or patients with previous DVT/PE, post-discharge prophylaxis for 2 to 4 weeks is recommended.*
3. ***Manipulation of epidural catheter** should be undertaken at the nadir (trough) of anticoagulant effect. With enoxaparin remove the catheter at least 10-12 hours after the dose and wait 2 hours to redose. If catheter is to remain in place, heparin use is **strongly** recommended, with redose > 1 hour after removal. If blood is present with catheter manipulation or multiple punctures employed, wait 24 hours to re-start any pharmacologic thromboprophylaxis.*
4. ***Patients with CrCL (~30 ml/min**, heparin is **strongly** recommended over enoxaparin. If enoxaparin is used, the manufacturer recommends 30mg SC QDay.*
5. *For morbidly obese patients (BMI>40 kg/M²) following bariatric surgery, enoxaparin 40mg SC Q12 hours was more effective than 30mg SC Q12 hours in an open trial.*
6. *TED and SCD are most effective when properly applied to the patient and are operating for > 23 hours per day.*

Date	Time	MD Signature	MD Name (printed)	MD I.D Number
Order Noted	Date	Time	Signature	Name (printed)

Improving VTE Prophylaxis at The Johns Hopkins Hospital

- Mandatory VTE risk stratification tool into the computerized provider order entry (CPOE) system
- Advanced computerized clinical decision support (CDS)

Streiff, BMJ 2012

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Benefits of the Computerized VTE Prevention System

- Puts VTE prevention into the work flow
- Enables rapid, accurate risk stratification and risk-appropriate VTE prophylaxis
- Applies evidence directly to clinical care
- Allows for performance monitoring/reporting

Streiff, BMJ 2012

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Keys to Success

- Multidisciplinary team
  - Physicians, Nurses, Pharmacists, Informatics
- Leadership buy-in
- Collaborate with service teams
- Educate front-line providers
- Measure baseline performance
- Conduct ongoing performance evaluations

Streiff, BMJ 2012

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Does Improving Prophylaxis Change Outcomes?

- We thought we were increasing quality and improving patient care
- But could we show hard data?

- YES
- Johns Hopkins Trauma Surgery Example

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Does Improving Prophylaxis Change Outcomes? The JHH Trauma Example

BUILDING A SURGICAL EXPERTISE IN INFORMATICS

Improved Prophylaxis and Decreased Rates of Preventable Harm With the Use of a Mandatory Computerized Clinical Decision Support Tool for Prophylaxis for Venous Thromboembolism

Elliott R. Haut, MD; Brandyn D. Lau, MPH; Franca S. Kraenzlin, MHS; Deborah B. Hobson, BSN; Peggy S. Kraus, PharmD, CACP; Howard T. Carolan, MPH, MBA; Adil H. Haider, MD, MPH; Christine G. Holzmueller, BLA; David T. Efron, MD; Peter J. Pronovost, MD, PhD; Michael B. Streiff, MD

Arch Surg. 2012;147(10):901-907

Haut, Arch Surg 2012

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Does Improving Prophylaxis Change Outcomes?

- Single Trauma Center
- Pre/Post Intervention Study
- 1-year PRE vs. 3-years POST
- Retrospective data collection
- IRB approved

Haut, Arch Surg 2012

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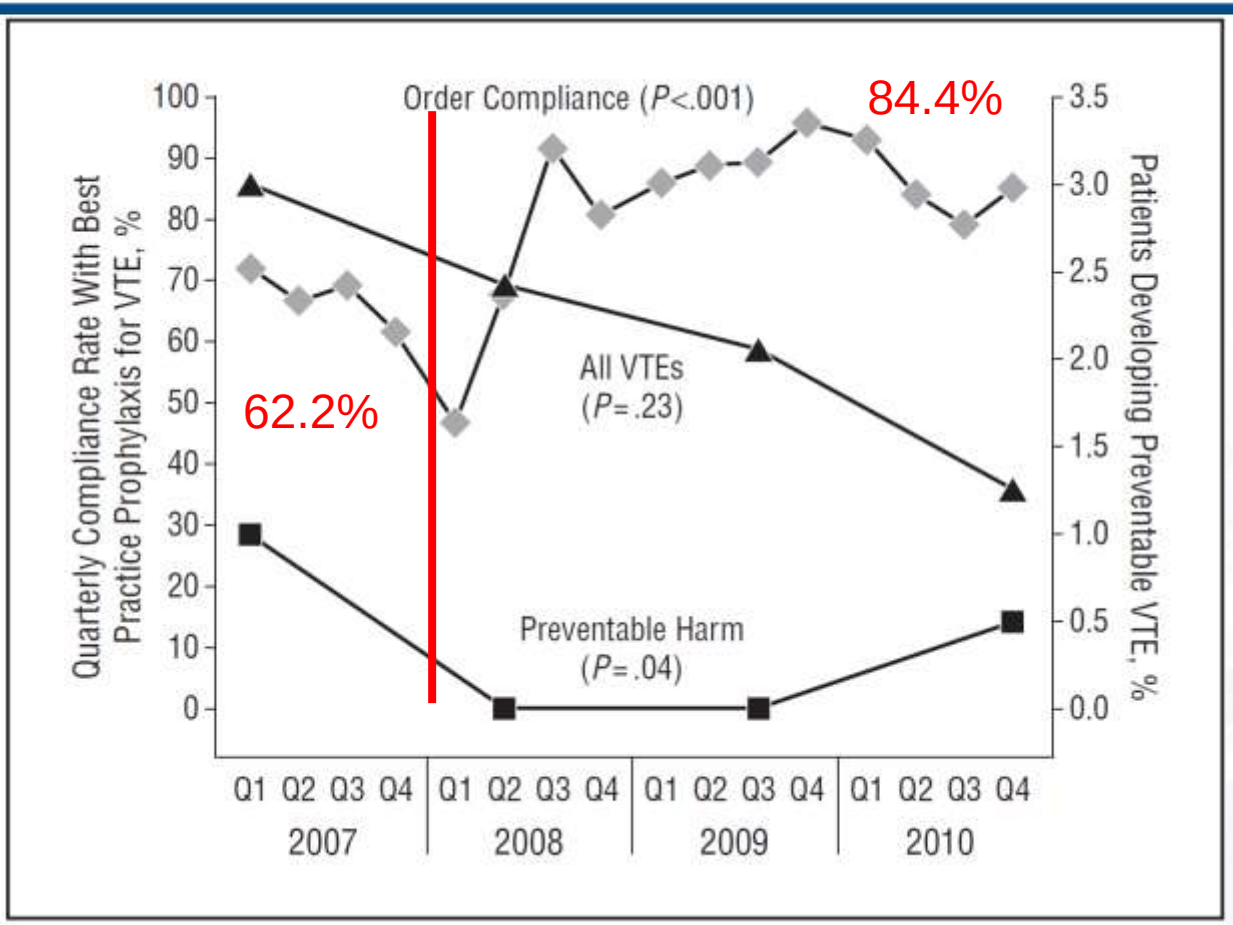
Does Improving Prophylaxis Change Outcomes?



- Significant increase in VTE prophylaxis
- Significant drop in preventable harm from VTE
  - 1.0% vs. 0.17% (p=0.04)

Haut, Arch Surg 2012

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VTE Prophylaxis- Computerized Decision Support

www.natfonline.org

Preventing Hospital-Acquired Venous Thromboembolism

A Guide for Effective Quality Improvement

AHRQ
Agency for Healthcare Research and Quality
Advancing Excellence in Health Care • www.ahrq.gov

Three Examples of Effective Implementation and Clinical Decision Support

The following are examples of effective order set design and implementation. They illustrate the central importance of implementation and clinical decision support techniques across disparate hospital settings and VTE risk assessment models.

The **Johns Hopkins** collaborative team used the "translating research into practice" (TRIP) model to implement mandatory VTE risk assessment and risk-appropriate prophylaxis.[5] The TRIP model is consistent with the principles presented throughout this guide. Important steps included summarizing the evidence from a centralized steering group; identifying barriers through pilot testing, good measurement, and feedback; and reinforcing appropriate prophylaxis through staff engagement, education, regular evaluation, good clinical decision support in order sets, and layered interventions to reinforce the protocol.[6]

www.AHRQ.gov 2015

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Improving VTE Prophylaxis Administration with Targeted Performance Feedback

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The Role of Health Informatics

- Harness the power of analytics
- Bringing performance data to individual providers and units
- Can competition drive improvements?

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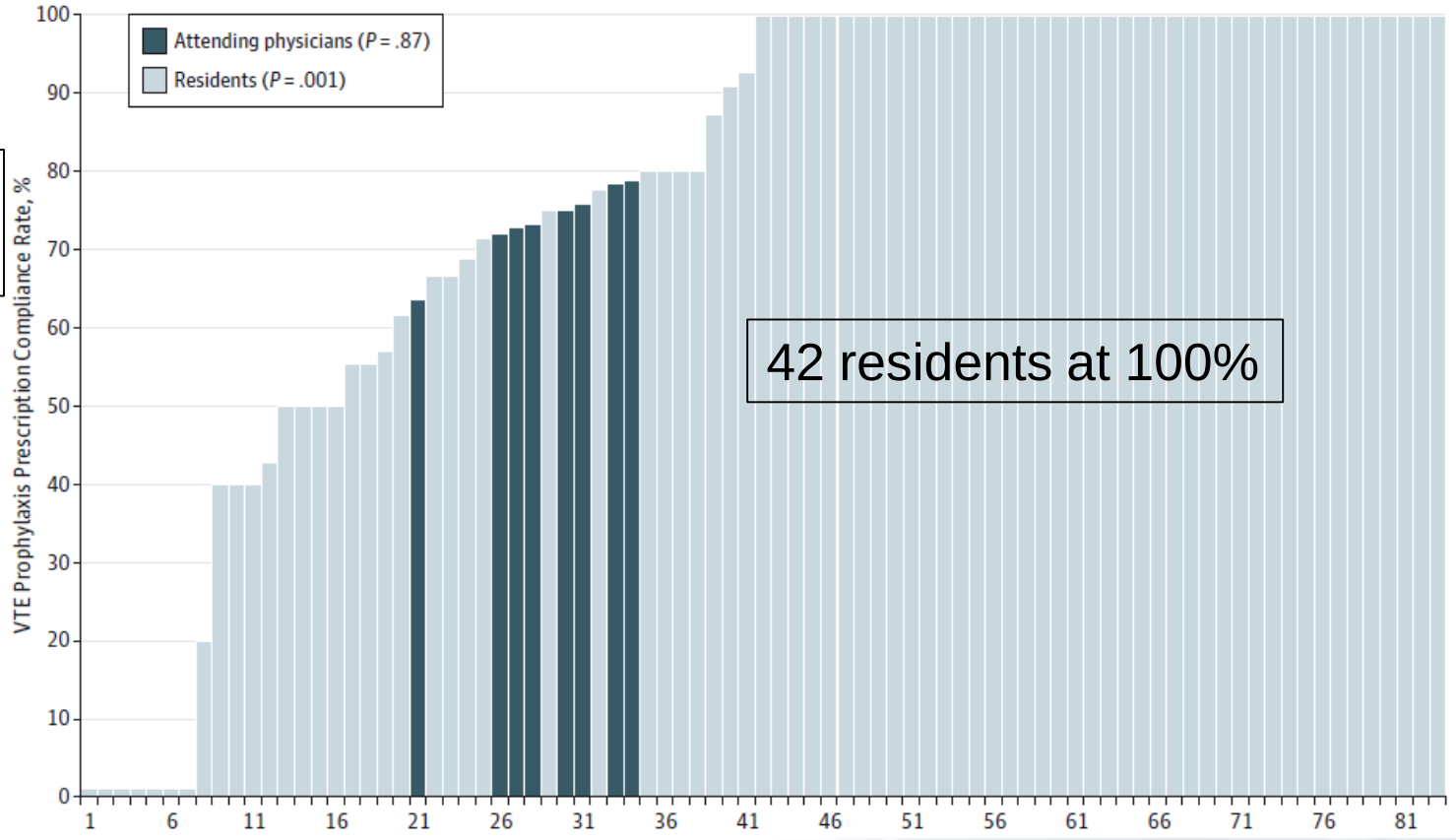
Trauma Attending & Resident Prophylaxis

Figure. Risk-Appropriate Venous Thromboembolism (VTE) Prophylaxis Prescription Compliance Rates



7 residents at 0%

42 residents at 100%

Lau, JAMA-Surg 2015

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RANK	UID	CURRENT MONTH September 2013		
		Compliant Orders	Number of Orders	Compliance
1	A033	11	11	100%
1	A111	12	12	100%
1	A092	2	2	100%
1	A112			n/a
1	A072	14	14	100%
1	A131	7	7	100%
1	A053	2	2	100%
1	A034	4	4	100%
1	A024	8	8	100%
1	A161	2	2	100%
1	A045			n/a
1	A025	5	5	100%
1	A035			n/a
1	A043	7	7	100%
1	A055	2	2	100%
1	A004	1	1	100%
1	A122			n/a
1	A121	1	1	100%
1	A014			n/a
1	A082			n/a
1	A062			n/a
22	A012	4	4	100%
23	A015	9	9	100%
23	A071	8	8	100%
25	A052	10	11	90.9%
26	A091	11	12	91.7%
26	A102	8	9	88.9%
28	A032	4	4	100%
29	A141	13	15	86.7%
30	A005	9	9	100%
31	A023	14	15	93.3%
32	A051	2	2	100%
32	A081	6	7	85.7%
34	A042	7	8	87.5%
35	A022	6	7	85.7%
			1	0.0%
			1	100%
			14	85.7%
			4	100%
			6	83.3%
			12	50.0%
			2	50.0%
			9	66.7%
			12	41.7%
45	A003	5	5	100%
46	A013	1	4	25.0%
OVERALL		235	268	87.7%

87.7% Sept

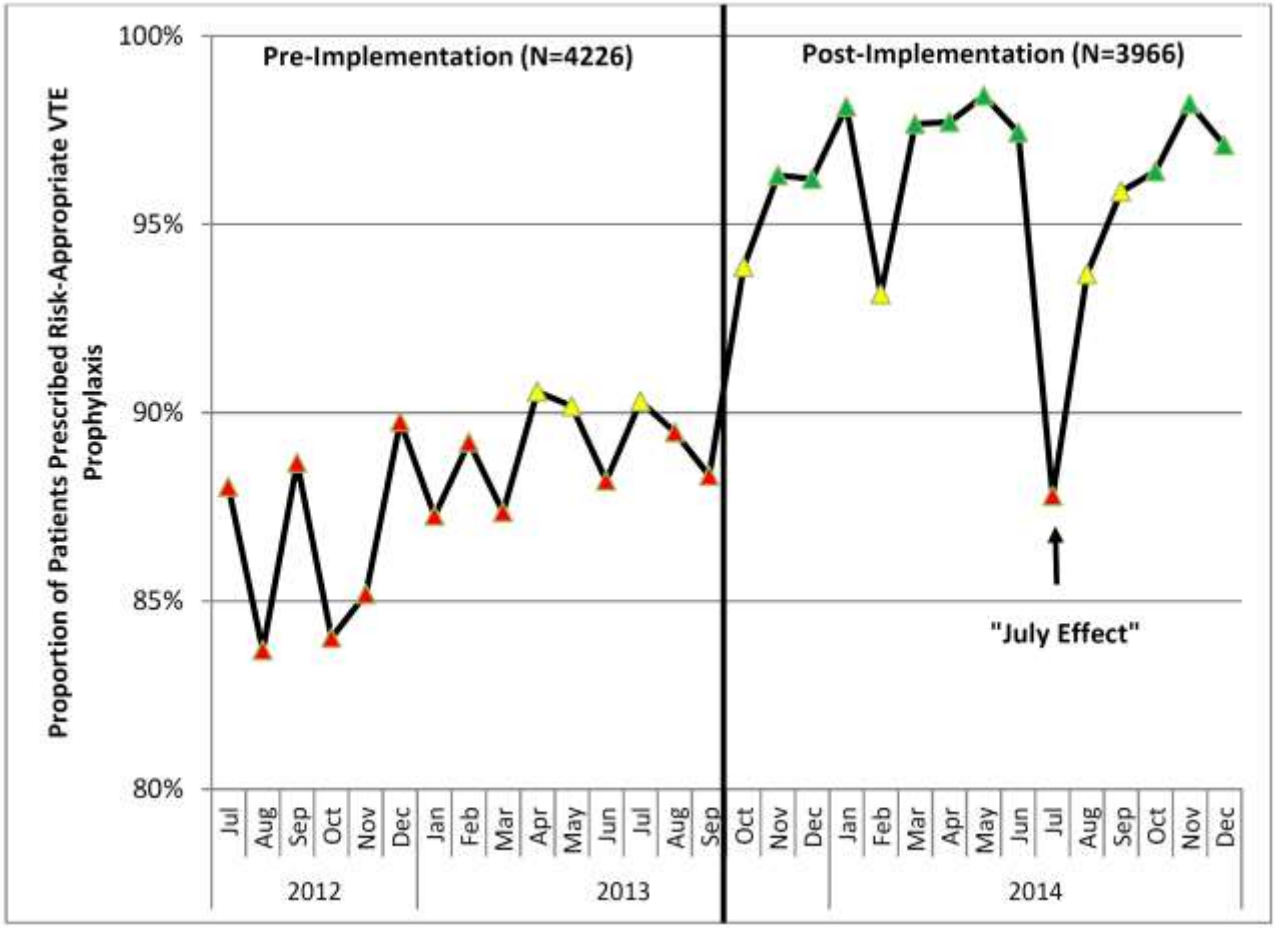
RANK	UID	CURRENT MONTH October 2013		
		Compliant Orders	Number of Orders	Compliance
1	A033	4	4	100%
1	A111	7	7	100%
1	A072	8	8	100%
1	A131	8	8	100%
1	A025	13	13	100%
1	A043	13	13	100%
1	A092	3	3	100%
1	A161	10	10	100%
1	A034	8	8	100%
1	A112	2	2	100%
1	A053	1	1	100%
1	A055	5	5	100%
1	A122	8	8	100%
1	A024			
1	A035	3	3	100%
1	A004	2	2	100%
1	A082			
1	A062			
19	A012	7	7	100%
20	A102	7	7	100%
			6	100%
			9	100%
			12	100%
			6	100%
			9	100%
			3	100%
			13	100%
			1	100%
			5	80.0%
30	A023	6	6	100%
31	A061	10	10	100%
32	A121	7	8	87.5%
33	A051	6	7	85.7%
34	A001	11	12	91.7%
35	A022			
35	A042	5	6	83.3%
37	A002	2	2	100%
38	A031	2	2	100%
39	A065	6	8	75.0%
39	A151	2	2	100%
41	A044	1	1	100%
42	A041			
42	A014	2	3	66.7%
44	A011	6	7	85.7%
45	A021	6	6	100%
46	A101	2	7	28.6%
47	A003	14	17	82.4%
48	A013			
Overall		260	277	93.9%

93.3% October

RANK	UID	CURRENT MONTH November 2013		
		Compliant Orders	Number of Orders	Compliance
1	A033	4	4	100%
1	A111	5	5	100%
1	A072	18	18	100%
1	A025	9	9	100%
1	A161	7	7	100%
1	A092	3	3	100%
				100%
				100%
				100%
				100%
				100%
				100%
				100%
				100%
				100%
1	A062	3	3	100%
18	A102	14	14	100%
19	A043	3	4	75.0%
20	A012			n/a
21	A091	9	9	100%
22	A081	9	9	100%
23	A141	1	1	100%
23	A052	2	2	100%
23	A032			n/a
23	A053	3	4	75.0%
27	A015	4	4	100%
28	A005			n/a
29	A045	1	1	100%
30	A023	8	8	100%
31	A121	4	4	100%
32	A061	17	18	94.4%
33	A042	12	12	100%
34	A071	10	12	83.3%
35	A065	11	11	100%
36	A001	1	1	100%
37	A051			n/a
38	A022			n/a
39	A002	1	1	100%
39	A014	2	2	100%
41	A041	11	11	100%
42	A031			n/a
43	A151	13	16	81.3%
44	A044			n/a
45	A101	9	9	100%
46	A003	7	7	100%
47	A021	2	2	100%
48	A011			n/a
49	A013	2	4	50.0%
Overall		260	270	96.3%

96.3% November

Surgery Resident Feedback Improves VTE Prophylaxis



Lau, Ann Surg 2015

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Missed Doses of VTE Prophylaxis

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A Big Assumption

- As physicians, we assume that medication orders we place are consistently delivered
- But is that truly the case?
- Does prescription = administration?

Steps to Optimal Pharmacologic VTE Prophylaxis

Do Missed VTE Prophylaxis Doses Matter?

- **Methods**
  - Retrospective analysis
  - 202 trauma and general surgery patients ordered enoxaparin
- **Results**
  - Overall incidence of DVT = 15.8%
  - 58.9% of patients missed >=1 dose
  - DVT compared missed vs. no missed doses
    - 23.5% vs. 4.8% ($p < 0.01$)

Louis, JAMA Surgery 2014

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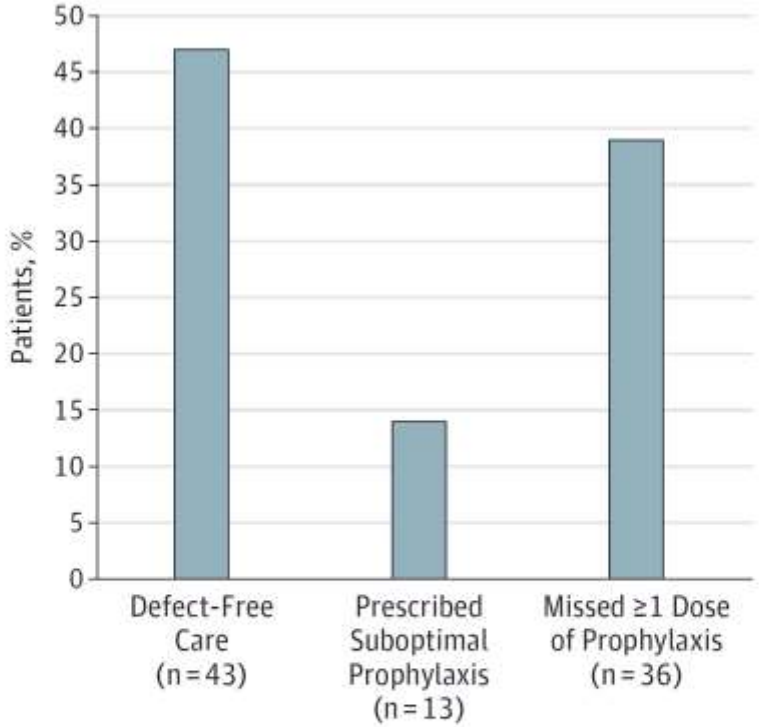
Do Missed VTE Prophylaxis Doses Matter?

- 92 VTE patients
- 39% missed >=1 dose of prophylaxis

Figure. Categorization of Patients With Hospital-Acquired VTE By Process of Care Appropriateness



Of the 92 patients with a venous thromboembolism (VTE), 43 (47%) received defect-free care, while 49 (53%) had truly potentially preventable VTE and were in the prophylaxis-failure group (ie, 13 of 92 patients were prescribed suboptimal prophylaxis [14%], and 36 of 92 patients missed ≥1 dose of prescribed prophylaxis [39%]).

Haut, JAMA Surgery 2015

Missed Doses of VTE Prophylaxis Medications at Johns Hopkins

- December 1, 2007 to June 30, 2008
  - >100,000 doses
  - 12% of doses not administered
    - Patient refusal most frequent (~60%) documented reason


PLOS ONE: Patterns of Non-Administration of Ordered Doses of Venous Thromboembolism Prophylaxis: Implications for Novel Interver

PLOS | ONE

Patterns of Non-Administration of Ordered Doses of Venous Thromboembolism Prophylaxis: Implications for Novel Intervention Strategies

Kenneth M. Shermock , Brandyn D. Lau, Elliott R. Haut, Deborah B. Hobson, Valerie S. Ganetsky, Peggy S. Kraus, Leigh E. Efird, Christoph U. Lehmann, Brian L. Pinto, Patricia A. Ross, Michael B. Streiff

Shermock, PlosOne 2013

What's the Real Story Behind Missed Doses?

- "Hidden Barriers to Delivery of Pharmacologic Venous Thromboembolism Prophylaxis"
  - SURVEY "I have the clinical knowledge and experience to determine if it is necessary to administer DVT/PE prophylaxis injections to patients."
    - AGREE 87%/79% medicine/surgery
  - FOCUS GROUP INTERVIEWS "We make the clinical decision all the time as to whether a patient needs VTE prophylaxis every day, based on how much the patient is ambulating."

Elder, Journal of Patient Safety epub 2014

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Our PCORI Project

pcori | Patient-Centered Outcomes Research Institute

- Preventing Venous Thromboembolism: Empowering Patients and Enabling Patient-Centered Care via Health Information Technology

Principal Investigator
Elliott Haut, MD, PhD

Organization	Funding Announcement
Johns Hopkins University	Assessment of Prevention, Diagnosis, and Treatment Options
State	**Project Budget**
Maryland	$1,499,194
Year Awarded	**Project Period**
2013	3 years

http://www.pcori.org/research-in-action/improving-patient-nurse-communication-prevent-life-threatening-complication

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Our PCORI Objectives

- 1) Enable patients to make informed decisions about their preventive care by improving the quality of patient-nurse communication about the harms of VTE and benefits of VTE prophylaxis
- 2) Empower patients to take an active role in their VTE preventive care
- 3) Identify and facilitate active engagement of patients who are not administered doses of VTE prophylaxis using a real-time escalating alert

http://www.pcori.org/research-in-action/improving-patient-nurse-communication-prevent-life-threatening-complication

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Our PCORI Collaborators / Key Stakeholders

ClotCare Online Resource

Helping others improve lives through anticoagulation

National Blood Clot Alliance

Stop The Clot®

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THE JOHNS HOPKINS HOSPITAL

Patient and Family Advisory Council

http://www.pcori.org/research-in-action/improving-patient-nurse-communication-prevent-life-threatening-complication

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PCORI Website "Research in Action"

Research & Results

OUR PROGRAMS

RESEARCH WE SUPPORT

HOW WE SELECT RESEARCH TOPICS

RESEARCH METHODOLOGY

PCORNET: THE NATIONAL PATIENT-CENTERED CLINICAL RESEARCH NETWORK

RESEARCH IN ACTION

COLLABORATING WITH OTHER RESEARCH FUNDERS

Improving Patient-Nurse Communication to Prevent a Life-Threatening Complication

Hospitalized patients are at increased risk for potentially fatal blood clots in their legs and lungs; a Baltimore team is exploring how to ensure wider use of preventive measures.

Baltimore, MD—Susan Kulik, DNP, MBA, RN was at her job as a surgical nurse at Johns Hopkins University Hospital in Baltimore when she slipped on a patch of wet floor and fractured her hip. The hospital admitted her right away for surgery to insert pins to stabilize her fractured bones.

The morning after the surgery, Kulik woke around 7 a.m., unable to breathe. "I got very dizzy and scared," Kulik says. "I thought I was going to die. It was an awful feeling."

A blood clot had formed in a vein deep in Kulik's leg, then broken off and traveled to her lung, where it blocked blood flow. This condition, venous thromboembolism (VTE), includes the formation of blood clots in deep veins and pulmonary embolism, in which a clot ends up in the lungs.

"I got very dizzy and scared ... I thought I was going to die. It was an awful feeling."
Susan Kulik

AT A GLANCE

Preventing Venous Thromboembolism: Empowering Patients and Enabling Patient-Centered Care via Health Information Technology

Principal investigator:
Elliott R. Haut, MD, PhD
Johns Hopkins University

Goal: To increase patient understanding and improve

What VTE Education Do Patients Really Want? Results from a Delphi Survey

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Modified Delphi Method

- Iterative process involving surveys, feedback and revisions
- Engaged patients and family members
- Recruited via email and/or social media (websites, Facebook, Twitter) through respective organizations
- > 400 respondents

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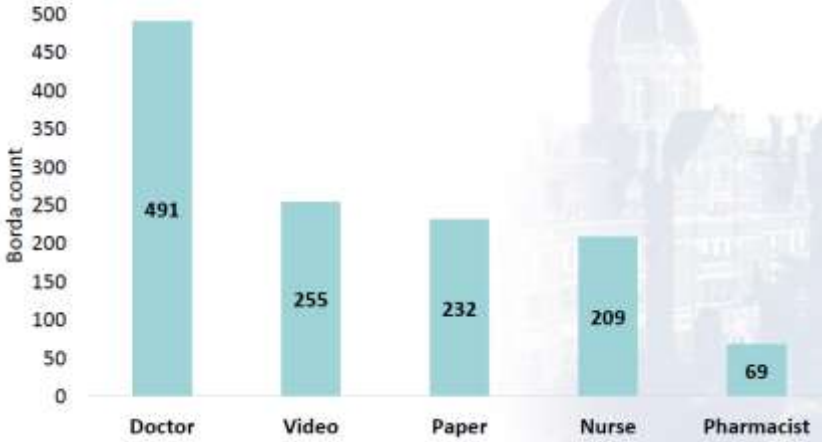
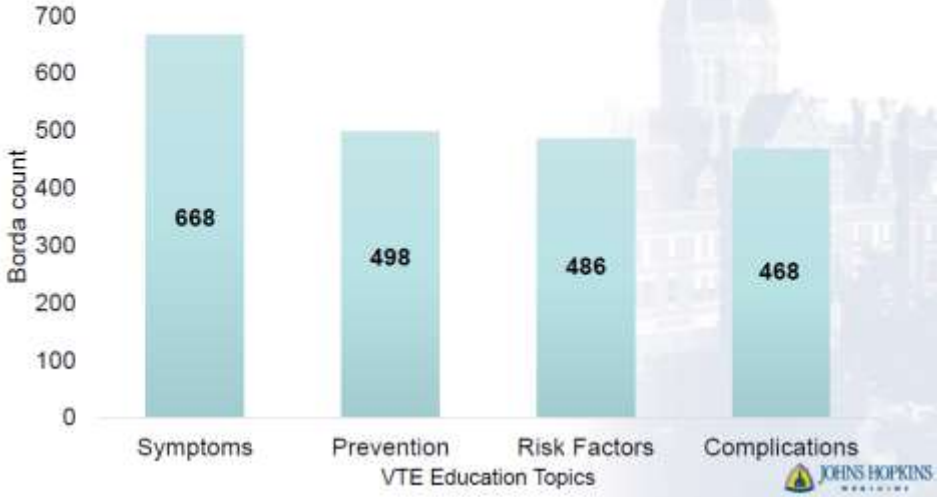
What Do Patients Want?

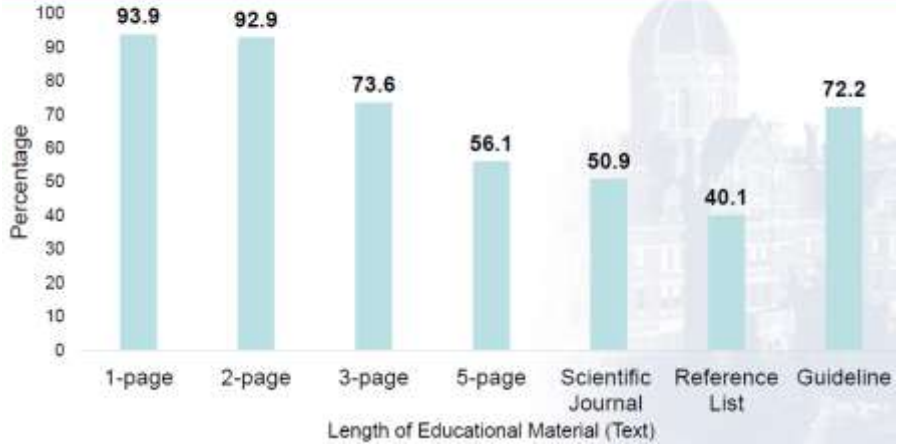
How Do Patients Want To Learn About VTE?



What Do Patients Want to Learn about VTE



How Much Are Participants Willing to Read?



Preferred Length Of Video?

What Do Patients Want?

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Patient VTE Education Menu

What Do Patients Want? Paper Form (2-pages)

	The Johns Hopkins Hospital Patient Information **How Do I Prevent Blood Clots?** **Venous Thromboembolism (VTE)** **Deep Vein Thrombosis (DVT)** **Pulmonary Embolus (PE)**	Original: Date 05/31/2014 Department: VTE Collaborative/Surgery
What is a blood clot or Venous Thrombo-embolism (VTE)?	Blood clots are called Venous Thromboembolism (VTE). There are 2 main types: • Deep Vein Thrombosis (DVT) is a clot in a deep vein, usually an arm or leg • Pulmonary Embolism (PE) is a clot that has broken off and traveled to the lungs. This can cause death.	

- www.hopkinsmedicine.org/armstrong/bloodclots

They spoke, we listened

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What Do Patients Want? Video

- Patients wanted
  - 10 minute video
  - Physicians, nurses and patients talking

- Screened for JHH PFAC
  - Changes based on group feedback

They spoke, we listened

http://bit.ly/bloodclots

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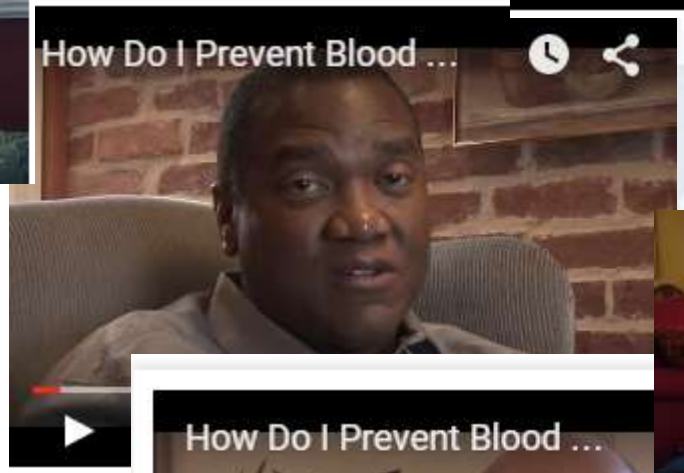
http://bit.ly/bloodclots Video



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What Do Patients Want?
Patient Education Intervention Project

- Real time alert of dose non-administration from POE system via pager/email
- Patient education bundle
  - Targeted education
  - Direct one-on-one discussion with nurse
  - Supported by paper handout and/or video
- Prospective Cohort Study
  - April 2015 to December 2015 (8 months)

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THE WALL STREET JOURNAL.

STYLE & FASHION
Your Top 7 Men's Style Questions for Fall, Answered

EATING & DRINKING
Europe (Finally) Wakes Up to Superior Coffee

ADVENTURE & TRAVEL
A Weekend Away in Southern England's Wine Country

RUMBLE SEAT
Subaru Forester: Function Over Form

LIFE | HEALTH | THE INFORMED PATIENT

Blood Clot Prevention Is Higher Priority at Hospitals

Many patients don't receive anticlotting drugs; nurses don't always give them

"Everyone assumed that once we got doctors to order the right medications, the rest would magically fall into place," says Dr. Haut. "It turns out that was very naive thinking. The nurse administration and patient acceptance phases are just as critical."

Dr. Haut is now leading a new project funded by the nonprofit Patient-Centered Outcomes Research Institute that includes training sessions for nurses about improving communication with patients and a special admission package for patients about taking an active role in clot prevention. Hopkins turned to some patients who have suffered blood clots to review the materials, talk to nurses, and tell their own stories in a video to convey the dangers of clots.

http://on.wsj.com/1M18Aqu

Hospitals are intensifying inpatient care to prevent potentially fatal blood clots. WSJ's Laura Landro and Johns Hopkins' Dr. Elliott Haut join Tanya Rivero on Lunch Break. Photo: Getty

By LAURA LANDRO
Aug. 3, 2015 2:20 p.m. ET

13 COMMENTS

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Acknowledgements

@elliotthaut
ehaut1@jhmi.edu

- Hopkins VTE Website (with paper forms)
  - http://www.Hopkinsmedicine.org/Armstrong/bloodclots
- Patient Education Video
  - http://bit.ly/bloodclots
- Wall Street Journal article
  - http://on.wsj.com/1M18Aqu
- PCORI Research in Action
  - http://www.pcori.org/research-in-action/improving-patient-nurse-communication-prevent-life-threatening-complication

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EXTRA SLIDES
Will NOT be Discussed

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Focus on VTE Prevention in Trauma

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Inferior Vena Cava (IVC) Filters for VTE Prophylaxis in Trauma

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Should we Place Prophylactic Inferior Vena Cava (IVC) Filters?

Conflicting Guidelines

VS.

Rogers, J Trauma 2002
Gould, CHEST 2012

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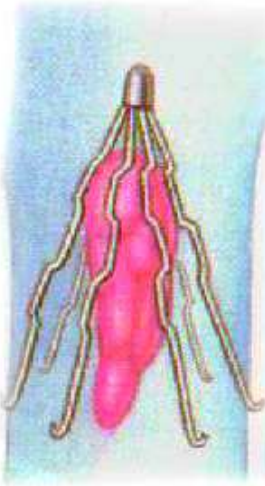
Should we Place Prophylactic Inferior Vena Cava (IVC) Filters?



- Conflicting Guidelines
- EAST “At this time, we recommend consideration of IVC filter insertion in patients without a documented DVT or PE who meet high-risk criteria and cannot be anticoagulated.” (Rogers J Trauma 2002)
- ACCP “For major trauma patients, we suggest that an IVC filter should not be used for primary VTE prevention (Grade 2C).” (Gould 2012 CHEST)

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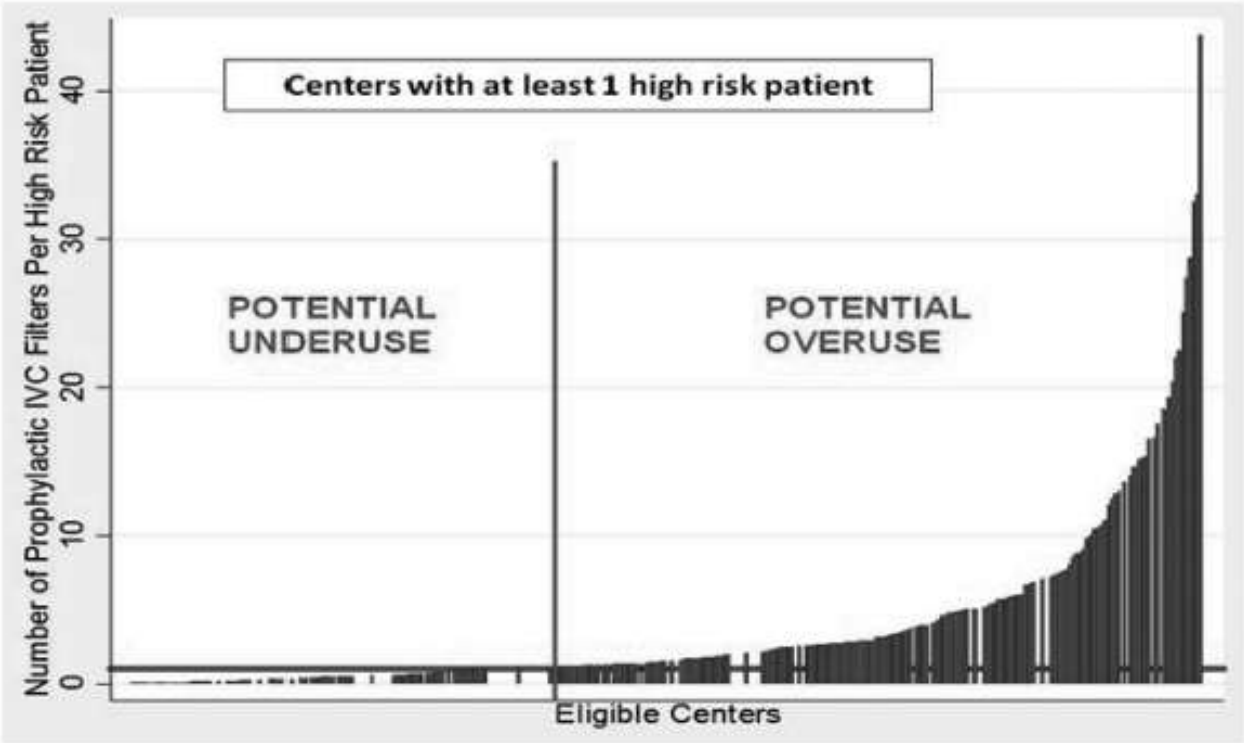
Variation in Prophylactic Inferior Vena Cava (IVC) Filter Use

Unwarranted National Variation in the Use of Prophylactic Inferior Vena Cava Filters After Trauma: An Analysis of the National Trauma Databank

Lesly A. Dossett, MD, MPH, Raeanne C. Adams, MD, and Bryan A. Cotton, MD, MPH, FACS



Should we Place Prophylactic Inferior Vena Cava (IVC) Filters?

Practice Patterns and Outcomes of Retrievable Vena Cava Filters in Trauma Patients: An AAST Multicenter Study

- 599 patients at 21 Trauma Centers
- Very low retrieval rate (22%)
- “The practice patterns of retrievable IVC filter use should be re-examined.”

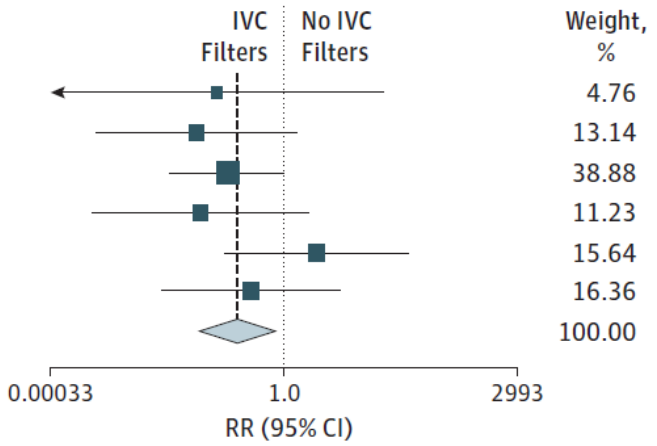
Karmy-Jones, J Trauma 2007

Should we Place Prophylactic Inferior Vena Cava (IVC) Filters?

- Number Needed to Treat (NNT) to prevent one PE is 109

Figure 2. Forest Plot of Relative Risk (RR) of Pulmonary Embolism (PE) With Use of Inferior Vena Cava (IVC) Filters vs No IVC Filters in Trauma Patients

	IVC Filters		No IVC Filters		
Source	No. of PE Events	Total No. of Participants	No. of PE Events	Total No. of Participants	RR (95% CI)
Wilson et al,[27] 1994	0	15	8	111	0.10 (0.00-29.45)
Khansarinia et al,[30] 1995	0	108	13	216	0.05 (0.00-1.50)
Rodriguez et al,[31] 1996	1	40	14	80	0.14 (0.02-1.05)
Gosin et al,[28] 1997	0	99	12	249	0.06 (0.00-2.29)
Gorman et al,[32] 2009	1	54	0	58	3.07 (0.13-71.20)
Rajasekhar et al,[25] 2011	0	18	1	16	0.32 (0.01-6.91)
All	2	334	48	730	0.20 (0.06-0.70)



Weights are calculated from random-effects analysis. Dashed line indicates the overall weighted point estimate (0.20); diamond, same overall weighted point estimate (95% CI). Shadow size varies relative to weight assigned to each study. Overall I^2 = 0% (P = .48). Test of RR = 1 (z = 2.52; P = .01).

Haut, JAMA Surgery 2013

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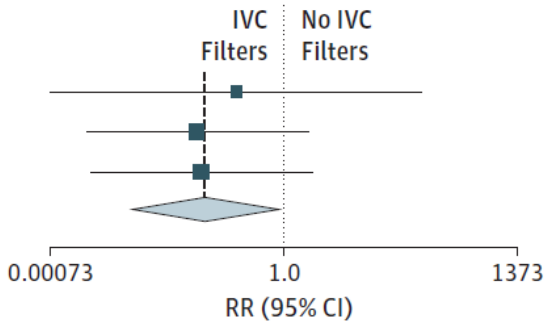
Should we Place Prophylactic Inferior Vena Cava (IVC) Filters?

- Number Needed to Treat (NNT) to prevent one fatal PE is 1099

Figure 3. Forest Plot of Relative Risk (RR) of Fatal Pulmonary Embolism (PE) With Use of Inferior Vena Cava (IVC) Filters vs No IVC Filters in Trauma Patients

	IVC Filters		No IVC Filters		
Source	No. of Fatal PE Events	Total No. of Participants	No. of Fatal PE Events	Total No. of Participants	RR (95% CI)
Wilson et al,[27] 1994	0	15	3	111	0.23 (0.00-70.76)
Khansarinia et al,[30] 1995	0	108	9	216	0.07 (0.00-2.16)
Rodriguez et al,[31] 1996	0	40	8	80	0.08 (0.00-2.40)
All	0	163	20	407	0.09 (0.01-0.81)



Weights are calculated from random-effects analysis. Dashed line indicates the overall weighted point estimate (0.20); diamond, same overall weighted point estimate (95% CI). Shadow size varies relative to weight assigned to each study. Overall I^2 = 0% (P = .94). Test of RR = 1 (z = 2.14; P = .03).

Haut, JAMA Surgery 2013

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Should we Place Prophylactic Inferior Vena Cava (IVC) Filters?

- Paper used MTQIP data - 803 patients
- Mortality- No difference
- DVT higher w/ IVCF (OR 1.83,1.15-2.93)
- Unadjusted PE rate higher w/ IVCF

Prophylactic Inferior Vena Cava Filter Placement Does Not Result in a Survival Benefit for Trauma Patients

Mark R. Hemmila, MD, Nicholas H. Osborne, MD,* Peter K. Henke, MD,* John P. Kepros, MD,† Sujal G. Patel, MD,‡ Anne H. Cain-Nielsen, MS,* and Nancy J. Birkmeyer, PhD**

Hemmila, Ann Surg 2015

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Can we Increase IVC Filter Removal?

Improved recovery of prophylactic inferior vena cava filters in trauma patients: The results of a dedicated filter registry and critical pathway for filter removal

59%

Frederick B. Rogers, MD, MS, FACS, Steven R. Shackford, MD, FACS, Jo Ann Miller, BSN, RN, CCRN, Daniel Wu, DO, Amelia Rogers, BSA, *and* Angela Gambler, MBA, *Lancaster, Pennsylvania*

Are retrievable vena cava filters placed in trauma patients really retrievable?

87%

W. R. Leeper[1,5] · P. B. Murphy[1,6] · K. N. Vogt[1] · T. J. Leeper[1] · S. W. Kribs[2] · D. K. Gray[1,3] · N. G. Parry[1,3,4,5]

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VTE Prophylaxis in Traumatic Brain Injury (TBI)

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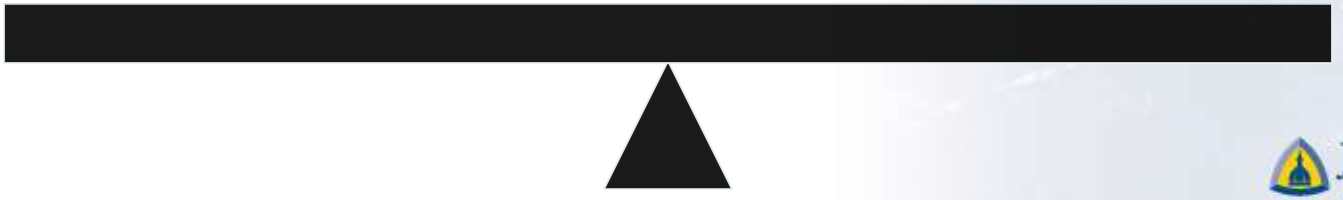
What is Optimal VTE Prophylaxis in Traumatic Brain Injury (TBI)?

- An Example Case:
  - You are the Trauma ICU attending and recently admitted a poly-trauma patient with:
    - TBI (small intraparenchymal contusion)
    - Flail chest
    - Pelvic fracture (no hematoma)
    - Bilateral femur fractures
  - What do you order to help prevent thromboembolism (VTE)?

Balance of Risk vs. Benefit

Pharmacologic Prophylaxis	NO Pharmacologic Prophylaxis
TBI Worse	VTE Event
More Neurosurgical Interventions	FULL Anticoagulation
Worse functional outcome	Worse functional outcome



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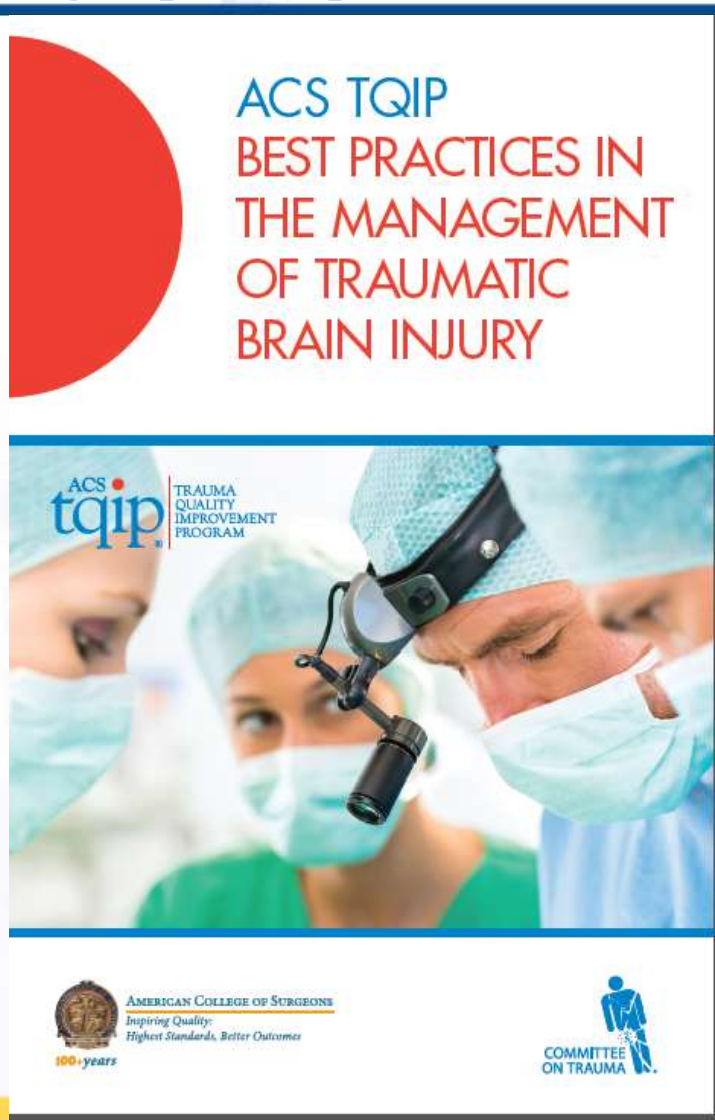
What is Optimal VTE Prophylaxis in Traumatic Brain Injury (TBI)?

- American College of Surgeons Trauma Quality Improvement Program (ACS-TQIP)
- “Best Practices in the Management of Traumatic Brain Injury”

https://www.facs.org/quality-programs/trauma/tqip/best-practice



ACS-TQIP recommendations for VTE Prophylaxis in TBI

Key Messages

- Patients with TBI are at high risk for venous thromboembolism (VTE), with rates as high as 20-30%
- VTE prophylaxis should be considered within the first 72 hours following TBI in most patients. Earlier initiation of pharmacologic prophylaxis (<72 hours) appears to be safe in patients at low risk for progression of intracranial bleeding and have a stable repeat head CT scan
- Placement of a prophylactic inferior vena cava (IVC) filter should be considered in patients at high risk for progression of intracranial hemorrhage who cannot receive pharmacologic prophylaxis, including those with lower extremity long bone fractures or pelvic fractures in addition to TBI

Table 3. Modified Berne-Norwood Criteria

Low risk	Moderate risk	High risk
No moderate or high risk criteria	Subdural or epidural hematoma > 8 mm Contusion or intraventricular hemorrhage > 2 cm Multiple contusions per lobe Subarachnoid hemorrhage with abnormal CT angiogram Evidence of progression at 24 hrs	ICP monitor placement Craniotomy Evidence of progression at 72 hrs
Initiate pharmacologic prophylaxis if CT stable at 24 hrs	Initiate pharmacologic prophylaxis if CT stable at 72 hrs	Consider placement of an IVC filter*

VTE in Injured Children

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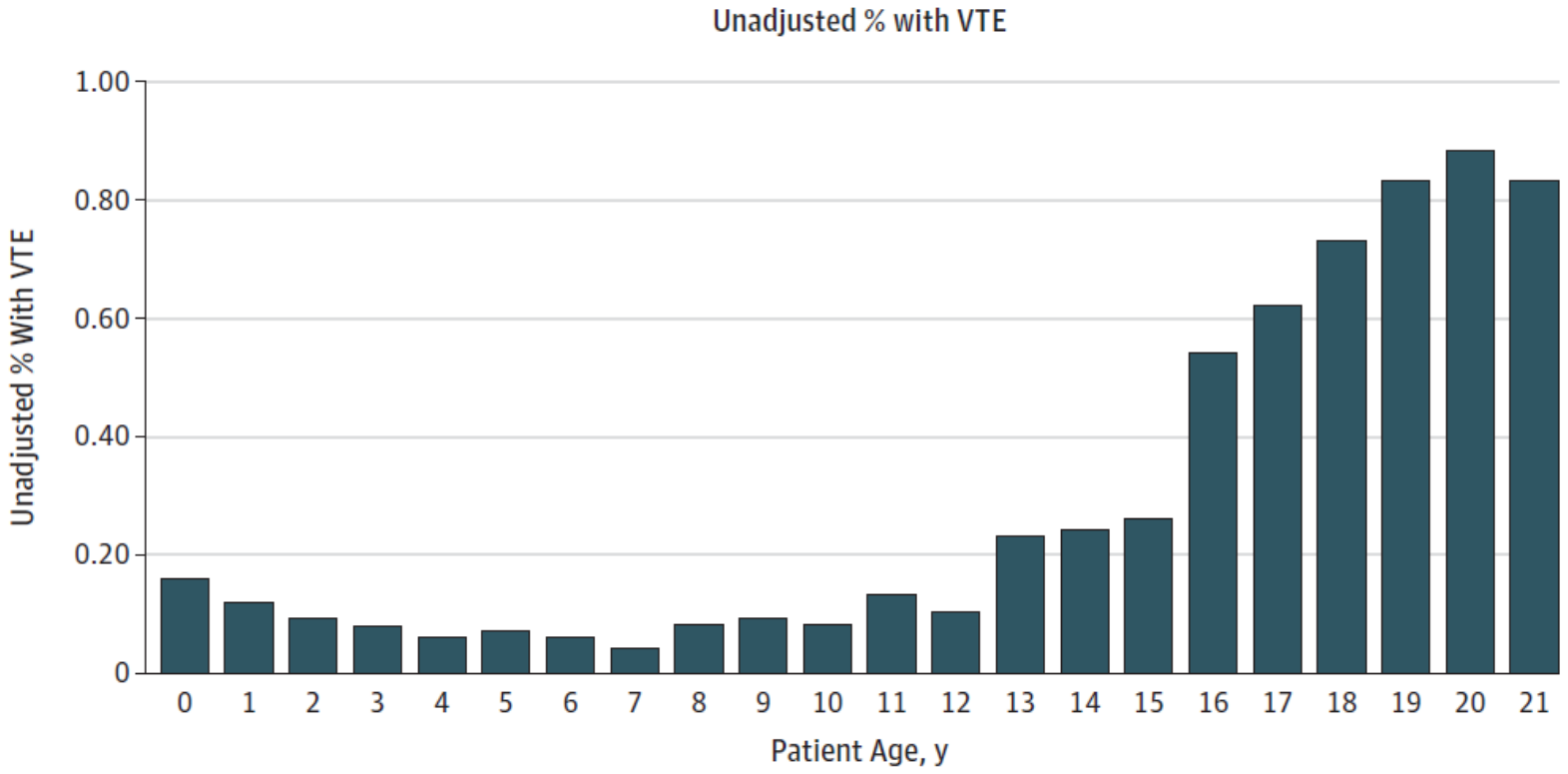
When Do Children Become Adults?

Figure. Unadjusted and Adjusted Risk of Venous Thromboembolism (VTE) After Trauma Across Patient Age



Van Arendonk, JAMA Surgery 2013

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When Do Children Become Adults?

- Adjusted OR 1.96 (95%CI 1.53-2.52) for 13-15 year olds
- Adjusted OR 3.77 (95%CI, 3.00-4.75) for 16-21 years
- 0-12 year olds as reference

Van Arendonk, JAMA Surgery 2013

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Does VTE Occur in Injured Children?

- Risk Predication Model for VTE in Children

Figure 2. Calculation of a Patient's Points Total and the Predicted Probability of Venous Thromboembolism (VTE) Given the Points Total

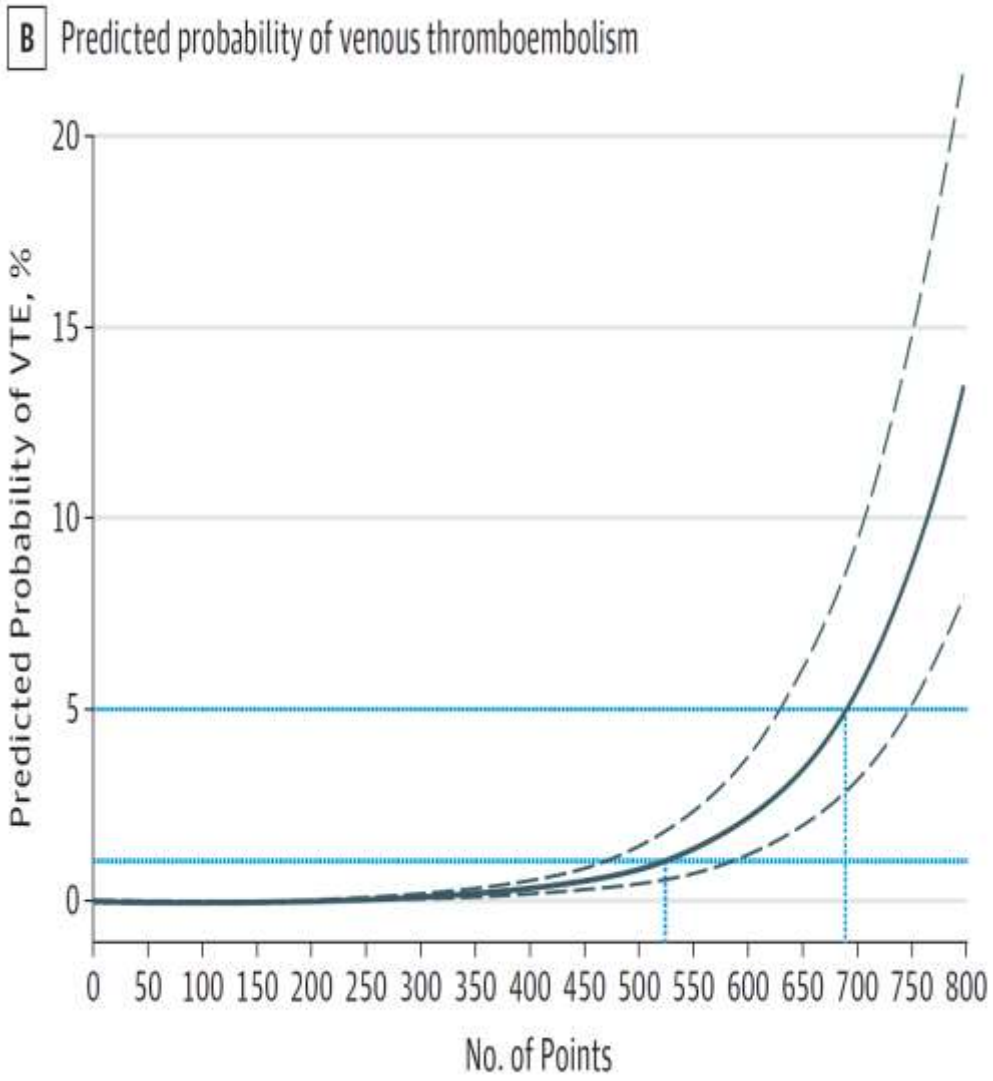
A Calculation of a patient's points total

	Points	
Characteristic	**Model 3**	**Model 3I**
GCS score		
Mild, 13-15	+0	+0
Moderate, 9-12	+40	+29
Severe, 3-8	+34	+101
Age category, y		
0	+94	+94
1-9	+0	+0
10-12	+78	+78
13-15	+120	+120
16-17	+147	+146
Female sex	+4	+4
Male sex	+0	+0
Intubation	+97	+143
Admission to ICU	+171	+186
Transfusion of blood products	+58	+57
Central venous catheter placement	+61	+61
Pelvic fracture	+33	+32
Lower-extremity fracture	+36	+37
Major surgery	+150	+149
Intubation AND admission to ICU	NA	-51
GCS category moderate AND admission to ICU	NA	+10
GCS category severe AND admission to ICU	NA	-70

Connelly, JAMA Surgery 2015

Does VTE Occur in Injured Children?

- Risk Predication Model for VTE in children
- Implications for Prophylaxis?



Connelly, JAMA Surgery 2015

Future of VTE Prophylaxis in Trauma

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The Future of VTE Prevention? What is on the Horizon?

- Current recommendations are basically a “one size fits all” approach
- Can we do better?
- Do different patients require different:
  - Medications (i.e. anti-platelets, aspirin)?
  - Doses?
  - Frequency?

The Future of VTE Prevention? What is on the Horizon?

- Precision medicine / targeted prevention

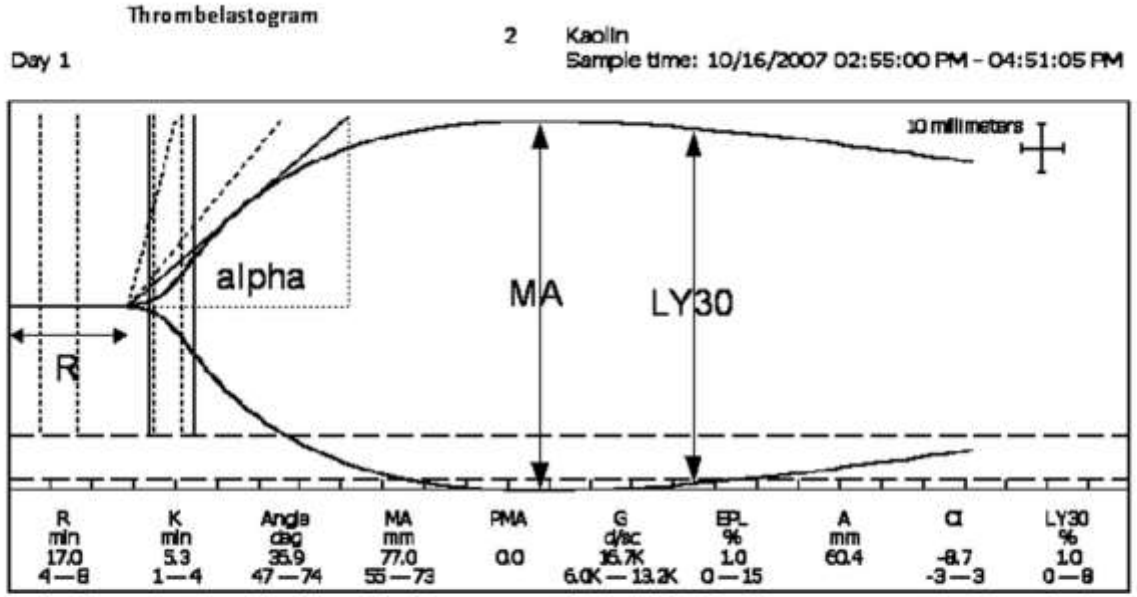

Fig. 2. *A sample TEG tracing showing various parameters. The initial time to clot formation (R) is measured in minutes. Alpha angle represents the rate at which the clot is strengthening. MA measured in millimeters and represents the maximum clot strength. The percentage of clot LY30 after MA represents fibrinolytic activity.*

Van, J Trauma 2009

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The Future of VTE Prevention? What is on the Horizon?

Thrombelastography Versus AntiFactor Xa Levels in the Assessment of Prophylactic-Dose Enoxaparin in Critically Ill Patients

Philbert Y. Van, MD, S. David Cho, MD, Samantha J. Underwood, MS, Melanie S. Morris, MD, Jennifer M. Watters, MD, and Martin A. Schreiber, MD

- Purpose "to analyze whether TEG could be used to predict which enoxaparin-treated patients would develop DVT."
- "TEG… may be used to guide dosing."

Van, J Trauma 2009

The Future of VTE Prevention? What is on the Horizon?

Admission rapid thrombelastography predicts development of pulmonary embolism in trauma patients

Bryan A. Cotton, MD, MPH, Kristin M. Minei, BA, Zayde A. Radwan, BS, Nena Matijevic, PhD, PharmD, Evan Pivalizza, MD, Jeanette Podbielski, BSN, Charles E. Wade, PhD, Rosemary A. Kozar, MD, PhD, *and* John B. Holcomb, MD, *Houston, Texas*

- "Admission r-TEG mA values can identify patients with an increased risk of in-hospital PE."
- "Further studies… whether alternative anticoagulation strategies should be used for these high-risk patients."

Cotton, J Trauma 2012

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The Future of VTE Prevention? What is on the Horizon?

Platelets are dominant contributors to hypercoagulability after injury

Jeffrey N. Harr, MD, MPH, Ernest E. Moore, MD, Theresa L. Chin, MD, Arsen Ghasabyan, MPH, Eduardo Gonzalez, MD, Max V. Wohlauer, MD, Anirban Banerjee, PhD, Christopher C. Silliman, MD, PhD, *and* Angela Sauaia, MD, PhD, *Denver, Colorado*

- "These data suggest an important role for antiplatelet therapy in VTE prophylaxis following trauma, particularly after 48 hours."

Harr, J Trauma 2013

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The Future of VTE Prevention? What is on the Horizon?

Coagulation Profile Changes Due to Thromboprophylaxis and Platelets in Trauma Patients at High-Risk for Venous Thromboembolism

CASEY J. ALLEN, M.D., CLARK R. MURRAY, B.S., JONATHAN P. MEIZOSO, M.D., JULIET J. RAY, M.D., LAURA F. TEISCH, B.S., XIOMARA D. RUIZ, M.D., MENA M. HANNA, M.D., GERARDO A. GUARCH, M.D., RONALD J. MANNING, ARNP, ALAN S. LIVINGSTONE, M.D., ENRIQUE GINZBURG, M.D., CARL I. SCHULMAN, M.D., PH.D., NICHOLAS NAMIAS, M.D., KENNETH G. PROCTOR, PH.D.

- "Platelet function is a dominant contributor to…. hypercoagulability."
- "Antiplatelet therapy may be indicated"

Allen, Am Surgeon 2015

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Acknowledgements

@elliotthaut
ehaut1@jhmi.edu

- Hopkins VTE Website (with paper forms)
  - http://www.Hopkinsmedicine.org/Armstrong/bloodclots
- Patient Education Video
  - http://bit.ly/bloodclots
- Wall Street Journal article
  - http://on.wsj.com/1M18Aqu
- PCORI Research in Action
  - http://www.pcori.org/research-in-action/improving-patient-nurse-communication-prevent-life-threatening-complication

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MTQIP Services

Jill Jakubus, PA-C, MHSA
Mark Hemmila, MD

HARNESSING POSITIVE DEVIANCE

Haiti

PROBLEM
Infant/Child Malnutrition

SOLUTION 1
Provide food

SOLUTION 2
Solar Oven

THE TWIST

Not all were impacted by malnutrition

QUESTION

How do you get food to the hungry?

QUESTION

How do you get the hungry to food?

FINAL SOLUTION
Positive deviant pairing

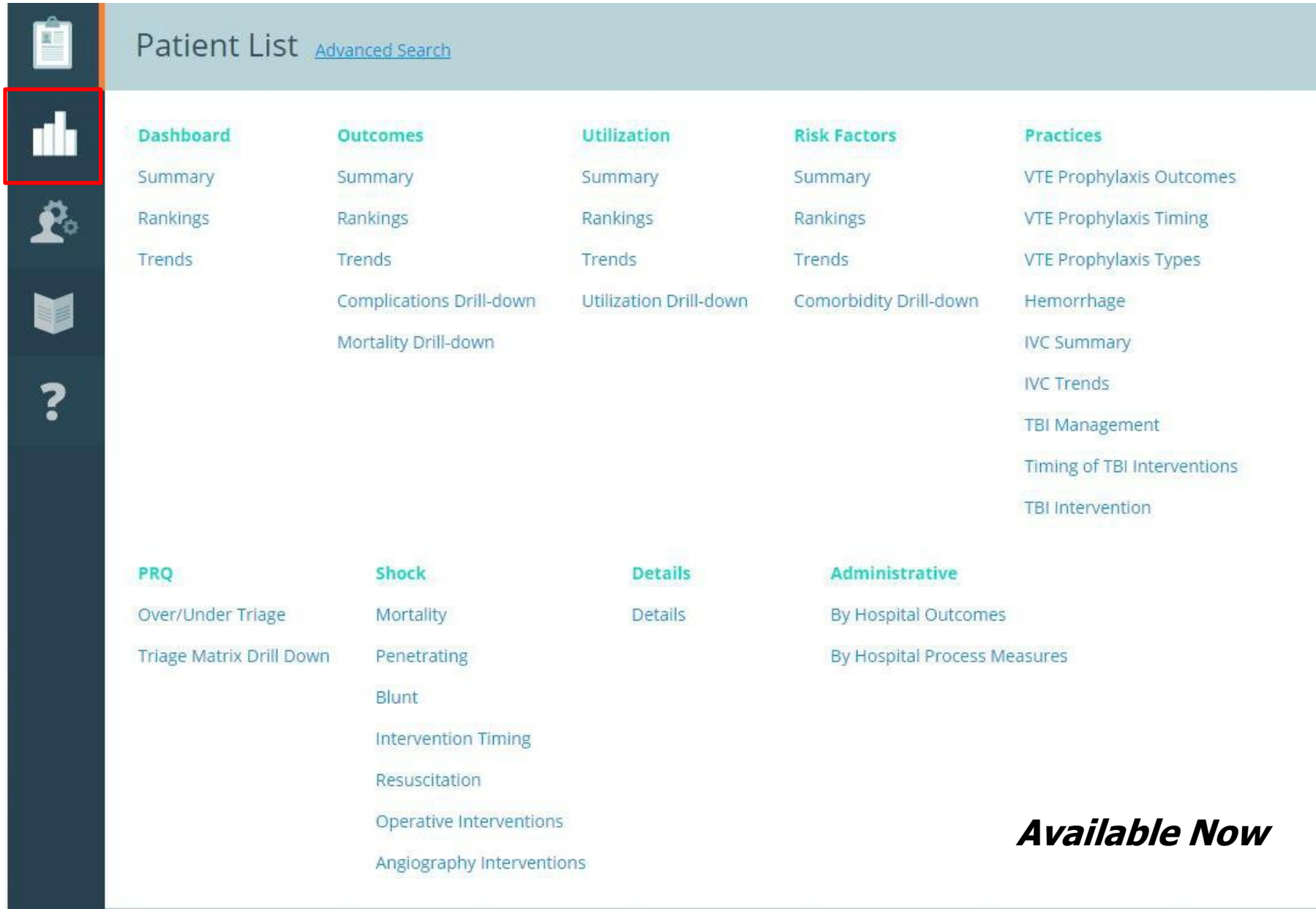
MTQIP Services

- Voluntary
  - Reach out, accept or decline
- Facilitate
  - Pairing of centers to share data and experience
  - Reach out, accept or decline
- ACS-TQIP Report
  - Review
  - Dive into data with MTQIP tools

Analytics
Guidelines
PI Resources
Data

Jill Jakubus, PA-C

Analytics – Shock



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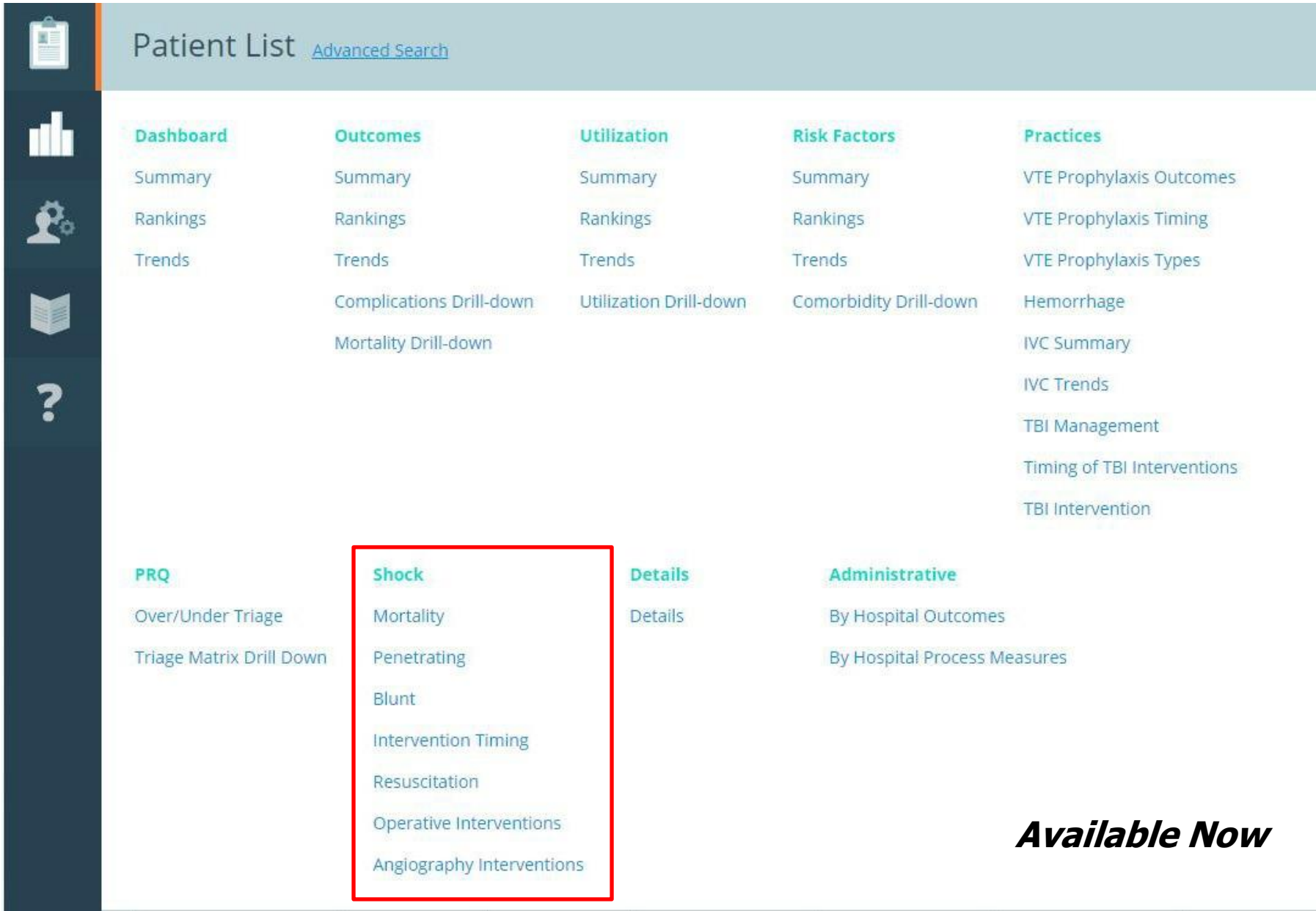
Analytics – Shock



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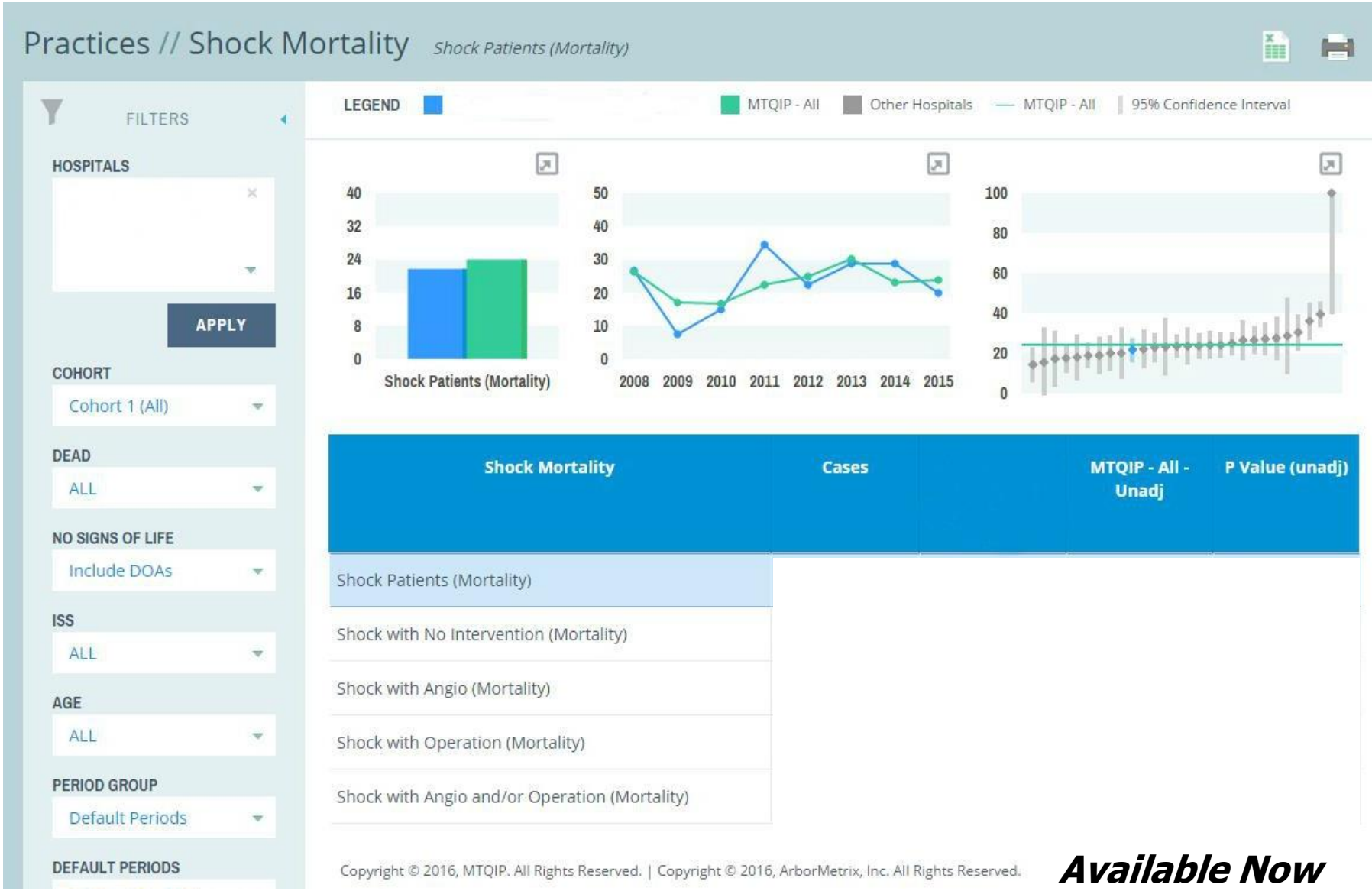

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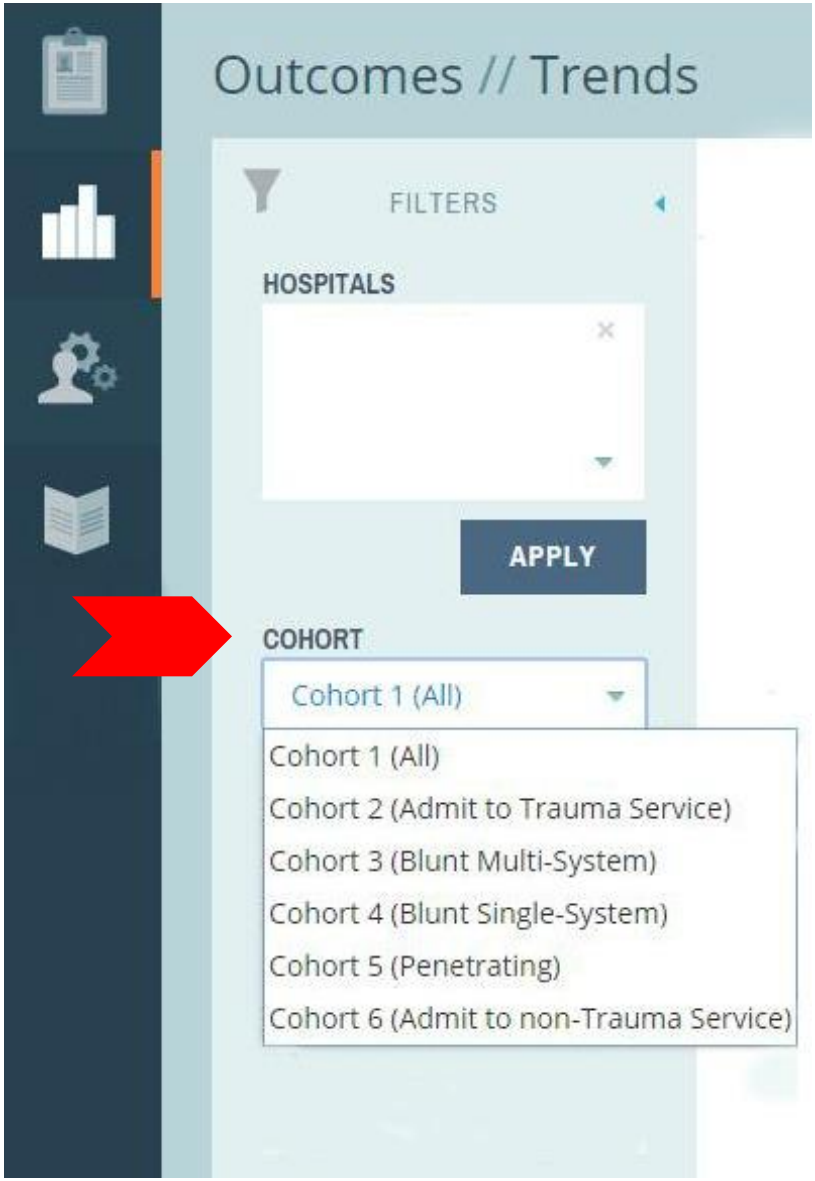
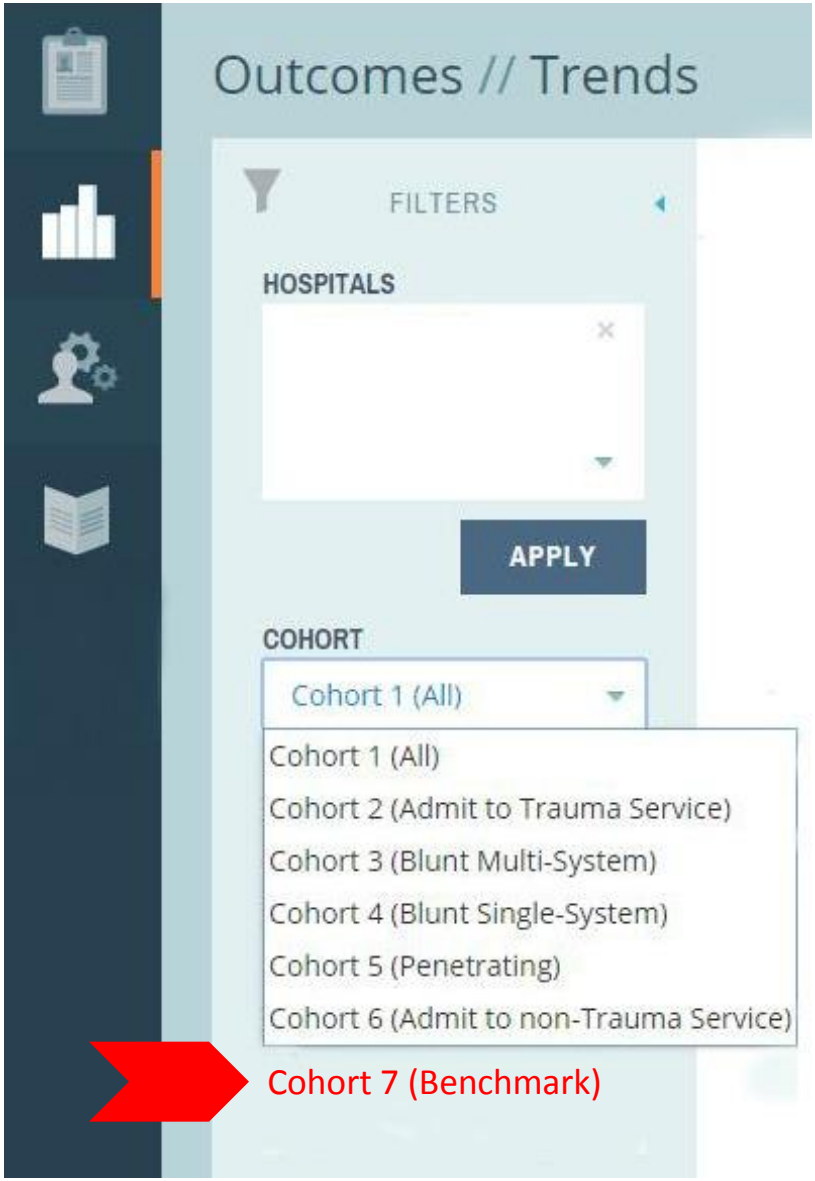
Analytics – Benchmark Filter



Coming Soon

Analytics – Benchmark Filter



Coming Soon

Guidelines – MTQIP Anticoagulation Reversal

	Interventions		
	General	Major Blood Loss	Critical Blood Loss (Life-threatening)
Dabigatran (Pradaxa)	Stop anticoagulant IV access – large bore Hemodynamic optimization	1. Antifibrinolytic 2. Oral activated charcoal (if last dose within 2 hrs) 3. Hemodialysis	1. Major blood loss interventions 2. Idarucizumab (Praxbind)
Apixaban (Eliquis)		1. Antifibrinolytic 2. Oral activated charcoal (if last dose within 6 hrs)	1. Major blood loss interventions 2. Unactivated or activated 4-factor PCC*
Rivaroxaban (Xarelto)		1. Antifibrinolytic 2. Oral activated charcoal (if last dose within 8 hrs)	

Available Now

Guidelines – MTQIP Anticoagulation Reversal

	Interventions		
	General	Major Blood Loss	Critical Blood Loss (Life-threatening)
Dabigatran (Pradaxa)	Stop anticoagulant IV access – large bore Hemodynamic optimization	1. Antifibrinolytic 2. Oral activated charcoal (if last dose within 2 hrs) 3. Hemodialysis	1. Major blood loss interventions 2. Idarucizumab (Praxbind)
Apixaban (Eliquis)		Andexanet Alpha	
Rivaroxaban (Xarelto)			

Coming Soon

Guidelines – MTQIP Anticoagulation Reversal

Thromb Haemost, 2012. 108(2): p. 217-24. LOE II

44. Maurice-Szamburski, A., T. Graillon, and N. Bruder, *Favorable outcome after a subdural hematoma treated with feiba in a 77-year-old patient treated by rivaroxaban.* J Neurosurg Anesthesiol, 2014. 26(2): p. 183. LOE V
45. Neyens, R., et al., *Dabigatran-associated subdural hemorrhage: using thromboelastography (TEG((R))) to guide decision-making.* J Thromb Thrombolysis, 2014. 37(2): p. 80-3. LOE V
46. Perzborn, E., et al., *Reversal of rivaroxaban anticoagulation by haemostatic agents in rats and primates.* Thromb Haemost, 2013. 110(1): p. 162-72. LOE IV
47. Pollack CV, Reilly PA, Eikelboom JW, et al. Idarucizumab for dabigatran reversal. NEJM, 2015. 373: p. 511-20. LOE II
48. Pragst, I., et al., *Reversal of dabigatran anticoagulation by prothrombin complex concentrate (Beriplex P/N) in a rabbit*

62. Warkentin, T.E., et al., *Recombinant factor VIIa (rFVIIa) and hemodialysis to manage massive dabigatran-associated postcardiac surgery bleeding.* Blood, 2012. 119(9): p. 2172-4. LOE V
63. Wong, H. and D. Keeling, *Activated prothrombin complex concentrate for the prevention of dabigatran-associated bleeding.* Br J Haematol, 2014. 166(1): p. 152-3. LOE V
64. Xu, Y., et al., *Differential profiles of thrombin inhibitors (heparin, hirudin, bivalirudin, and dabigatran) in the thrombin generation assay and thromboelastography in vitro.* Blood Coagul Fibrinolysis, 2013. 24(3): p. 332-8. LOE V
65. Zhou, W., et al., *Hemostatic therapy in experimental intracerebral hemorrhage associated with the direct thrombin inhibitor dabigatran.* Stroke, 2011. 42(12): p. 3594-9. LOE IV

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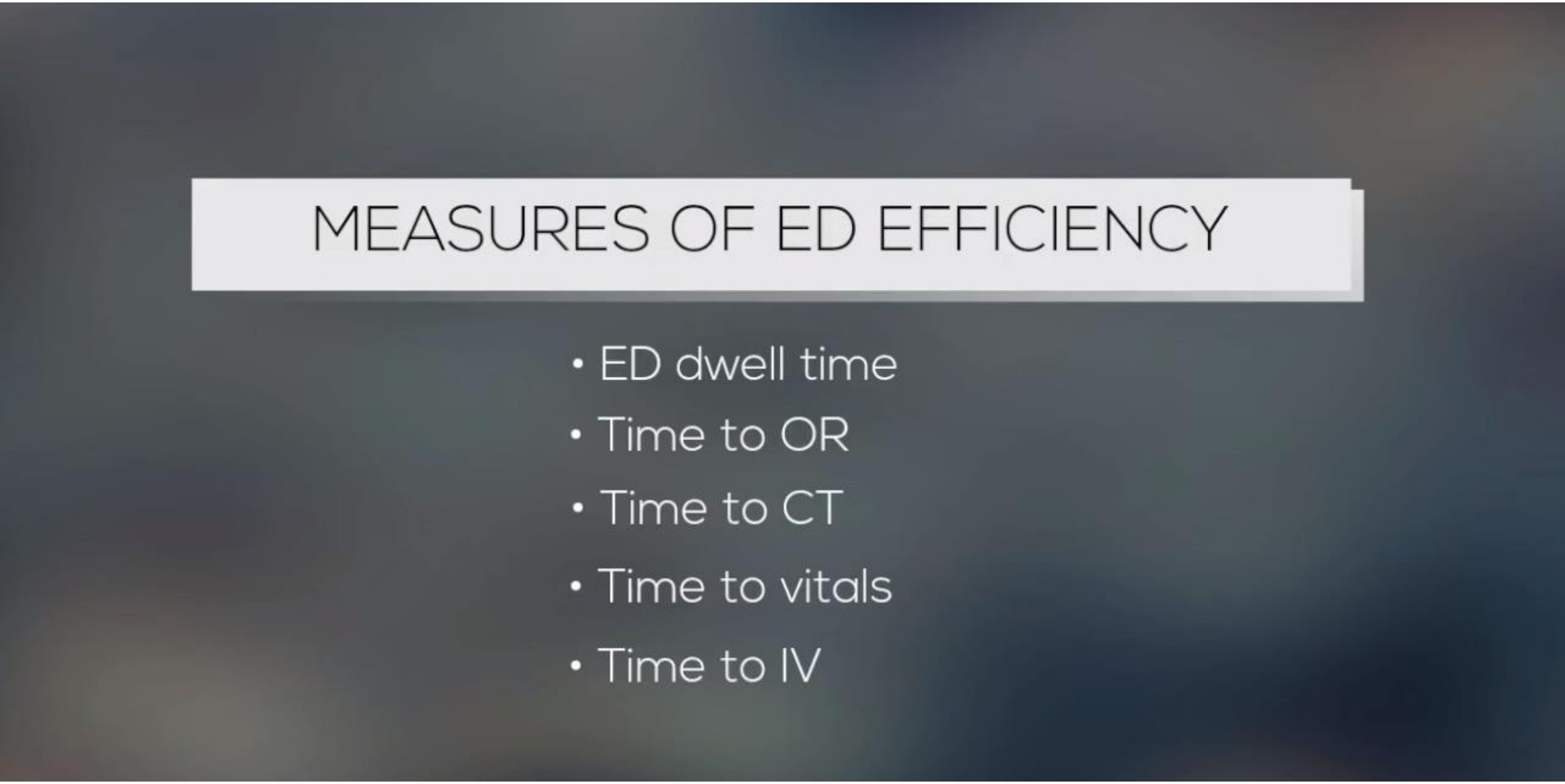
PI Resources – Hurley Module



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PI Resources – PI Library

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PI Resources – PI Library

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True Faith	5:49	New Order	International - Th...	Pop		8	7/2/2007 10:
Photograph	3:54	Nickleback	Promo CD	Rock		39	10/12/2006 1
Nobody Knows	3:57	P!nk	I'm Not Dead	Pop		5	7/8/2007 8:0
I Have Seen the Rain (Featuring J...	3:29	P!nk	I'm Not Dead	Pop		6	7/8/2007 8:0
Who Knew	3:28	P!nk	I'm Not Dead (Intern...	Pop		204	7/8/2007 8:0
No Surprises	3:49	Radiohead	Coastal Chill	Easy Listening		152	11/7/2006 7:
Unfaithful	3:46	Rihanna	A Girl Like Me	Pop		126	7/2/2007 10:
Talking in Your Sleep	7:31	The Romantics	New York: A Mix Ody...	Electronica ...			
I Wish I Was a Punk Rocker (With ...	2:30	Sandi Thom	Smile... It Confuses ...	Music		76	11/9/2006 6:
Sweet Surrender (Tiësto Mix)	7:03	Sarah McLachlan (TD...		Trance			
Two Beds and a Coffee Machine	3:27	Savage Garden	Affirmation	Pop		2	7/2/2007 10:
Santa Monica	3:34	Savage Garden	Savage Garden	Pop		3	7/8/2007 8:0
CAFFEINE IN THE MORNING SUN	4:22	The Sleepy Jackson	Coastal Chill	Easy Listening			
Happy Endings	4:44	Something for Kate	Coastal Chill	Easy Listening			
I Believe (When I Fall In Love	4:51	Stevie Wonder	High Fidelity Soundtrack				
ZLBM	4:12	switchfoot		Soundtrack			
stars (sophie muller watermark)	4:08	switchfoot		Alternative		43	7/2/2007 10:
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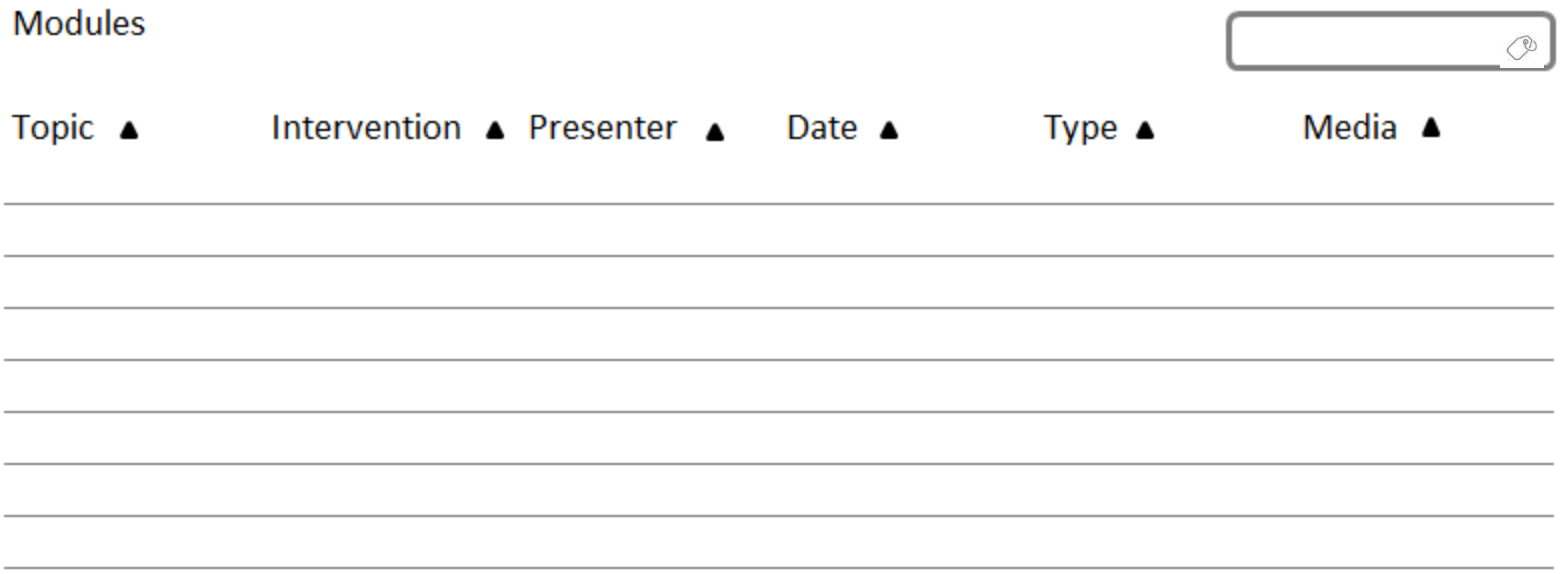
PI Resources – PI Library



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Data – AIS 2015

- **Anticipated release early 2016**
- **MTQIP request for conversion as group to protect data integrity at interval TBD**
- **No conversion at this time interval planned per TQIP**

Conclusion

- Evaluations
  - Fill out and turn in
- Questions?
- See you in May