The Michigan Trauma Quality Improvement Program

Grand Rapids, MI
May 8, 2019

Disclosures

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

No Photos Please

Evaluations

- Paper, hand in
- No CME

Guests

- BCBSM
  - Faris Ahmad, MD
  - Ellen Ward
  - Monica Whitted
- Speakers
  - Kristen Sihler MD
  - Wendy Wahl MD

Data Submission

- Data submitted February 1, 2019
  - This report
  - 4 week turnaround
- Data submitted April 5, 2019
  - Up yesterday
- Next data submission
  - June 7, 2019

Future Meetings

- Spring (Registrars and MCR's)
  - Tuesday June 4, 2019
  - Ypsilanti, EMU Marriott
- Fall
  - Tuesday October 8, 2019
  - Ypsilanti, EMU Marriott
- Winter
  - Tuesday February 11, 2020
  - Ypsilanti, EMU Marriott

State of Michigan

- FY 2019 (Oct to Sep)
  - Level 3's
  - Data Validation (5 Level 3's)
- FY 2020
  - Proposal submitted
  - Level 3's
  - Expanded Level 3 data validation
  - State and region reporting (Level 1,2,3)

Pelvic Fracture Data

Mark Hemmila, MD

AAST Presentation/JTACS Paper

AAST 2018 Podium Paper

American College of Surgeons Committee on Trauma verification level affects trauma center management of pelvic ring injuries and patient mortality

Bryant W. Oliphant, MD, MBA, MSc, Christopher J. Tignanelli, MD, Lena M. Napolitano, MD, James A. Goulet, MD, *and* **Mark R. Hemmila, MD**, *Ann Arbor, Michigan*

BACKGROUND: Pelvic ring fractures represent a complex injury that requires specific resources and clinical expertise for optimal trauma patient management. We examined the impact of treatment variability for this type of injury at Level I and II trauma centers on patient outcomes.

METHODS: Trauma quality collaborative data (2011–2017) were analyzed. This includes data from 29 American College of Surgeons Committee on Trauma verified Level I and Level II trauma centers. Inclusion criteria were adult patients (≥16 years), Injury Severity Score of 5 or higher, blunt injury, and evidence of a partially stable or unstable pelvic ring fracture injury coding as classified using Abbreviated Injury Scale version 2005, with 2008 updates. Patients directly admitted, transferred out for definitive care, with penetrating trauma, or with no signs of life were excluded. Propensity score matching was used to create 1:1 matched cohorts of patients treated at Levels I or II trauma centers. Trauma center verification level was the exposure variable used to compare management strategies, resource utilization, and in-hospital mortality in univariate analysis.

RESULTS: We selected 1,220 well-matched patients, from 1,768 total patients, using propensity score methods (610 Level I and 610 Level II cohort). There were no significant baseline characteristic differences noted between the groups. Patients with pelvic ring fractures treated at Level I trauma centers had significantly decreased mortality (7.7% vs. 11.6%, $p = 0.02$). Patients treated at Level II trauma centers were less likely to receive interventional angiography, undergo complicated definitive orthopedic operative treatment, and to be admitted to an intensive care unit.

CONCLUSION: Admission with a partially stable or unstable pelvic ring injury to a Level I trauma center is associated with decreased mortality. Level II trauma centers had significantly less utilization of advanced treatment modalities. This variation in clinical practice highlights potential processes to emphasize in the appropriate treatment of these critically ill patients. (*J Trauma Acute Care Surg.* 2019;86: 1–10.

LEVEL OF EVIDENCE: Economic/Decision, Level II.

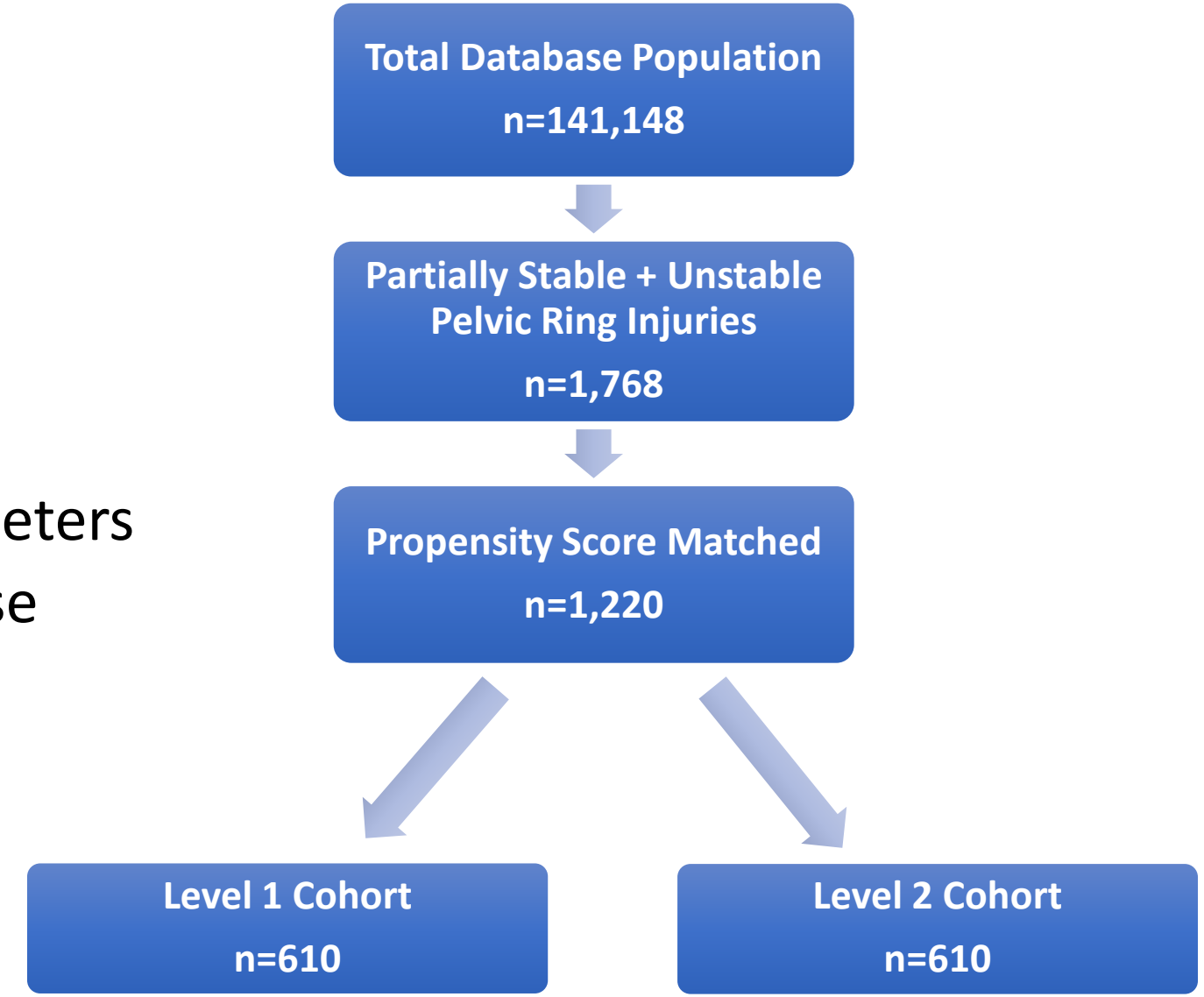
KEY WORDS: Trauma outcomes; trauma registry; quality improvement; collaborative quality improvement; complications.

Analytic Method

Propensity Score Matched

- Demographics
- Injury severity parameters
- Admission vital sign parameters
- Pre-injury anticoagulant use
- Transfer in status

No significant differences in patient characteristics (Table 1)



Higher Mortality in Level 2 Centers

48 Hour

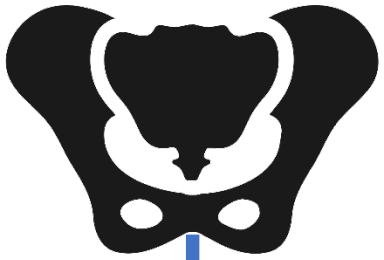
3.4% Level 1 < **6.2% Level 2**

p=0.04

Total

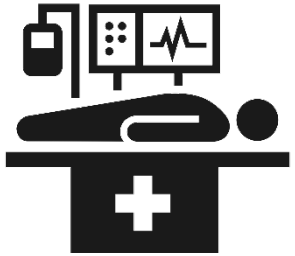
7.7% Level 1 < **11.6% Level 2**

p=0.02

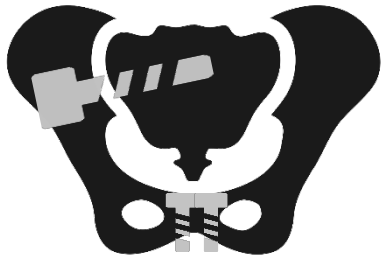


Level 1

Angiography/Embolization



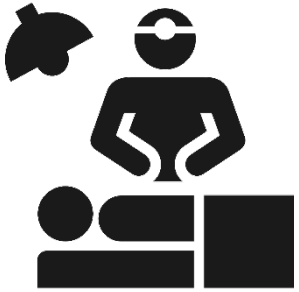
ICU Admission



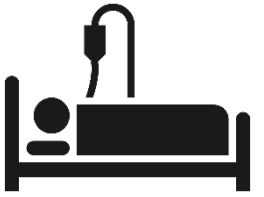
ORIF/CRPP

Level 2

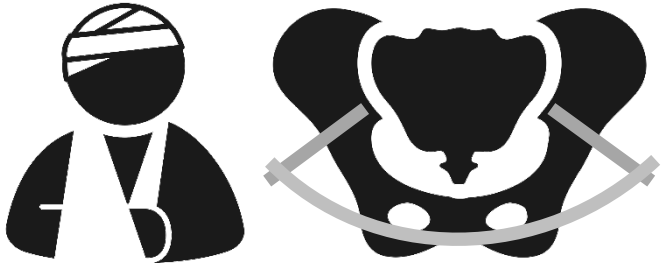
Exploratory Laparotomy



Stepdown Admission



Non-op Treatment
External Fixation



October Meeting

- Member feedback
  - We transfer these patients
  - Why would Level 2 centers do worse if we transfer out the patients
  - Good questions
- Data
  - 2nd look

Data

- MTQIP
  - ISS ≥ 5
  - Admit or Death in ED
- What happens to a transfer out
  - If alive and not admitted > not in MTQIP data
  - If alive, admitted, and transferred later > in MTQIP data
  - Transferred in is tracked and adjusted for

TABLE 1. Patient Characteristics

	Entire Sample			Propensity-Matched Cohort		
	Level I	Level II		Level I	Level II	
Characteristics	**n = 1105**	**n = 663**	***p* value**	**n = 610**	**n = 610**	***p* value**
Age, n (%)			0.6			0.98
16–25	213 (19)	94 (14)		95 (15)	88 (14)	
26–45	280 (25)	177 (27)		161 (26)	163 (27)	
46–65	364 (33)	219 (33)		199 (33)	206 (34)	
66–75	89 (8)	58 (9)		53 (9)	54 (9)	
>75	159 (15)	115 (17)		102 (17)	99 (16)	
Male sex, n (%)	607 (55)	364 (55)	0.99	333 (55)	341 (56)	0.6
Race, n (%)			0.003			0.6
White	879 (80)	514 (78)		487 (80)	473 (78)	
Black	164 (15)	129 (19)		104 (17)	117 (19)	
Other	62 (5)	20 (3)		19 (3)	20 (3)	
Private insurance, n (%)	722 (65)	423 (64)	0.5	387 (63)	390 (64)	0.9
Transfer in, n (%)	372 (34)	122 (18)	<0.001	116 (19)	120 (20)	0.8
ED GCS motor score, n (%)			0.2			0.4
6	858 (78)	534 (81)		507 (83)	486 (80)	
5–2	88 (8)	55 (8)		48 (8)	53 (9)	
1	122 (11)	60 (9)		45 (7)	57 (9)	
Missing	37 (3)	14 (2)		10 (2)	14 (2)	
ISS, n (%)			0.001			0.5
5–15	266 (24)	207 (31)		182 (30)	172 (28)	
16–24	352 (32)	218 (33)		204 (34)	207 (34)	
25–35	252 (23)	137 (21)		143 (23)	133 (22)	
>35	235 (21)	101 (15)		81 (13)	98 (16)	

4+ Units PRBC in 4 h, n (%)	362 (33)	228 (34)	0.5	204 (33)	205 (34)	0.95
AIS head/neck score >2, n (%)	212 (19)	98 (15)	0.02	97 (16)	96 (16)	0.9
AIS chest score >2, n (%)	423 (38)	223 (34)	0.05	207 (34)	215 (35)	0.6
AIS abdomen score >2, n (%)	245 (22)	124 (19)	0.08	118 (19)	119 (20)	0.9
AIS extremity score >2, n (%)	1105 (100)	663 (100)	0.99	610 (100)	610 (100)	0.99
Intubated, n (%)	747 (68)	460 (69)	0.4	404 (66)	425 (70)	0.2
Prehospital CPR, n (%)	13 (1)	10 (2)	0.6	6 (1)	9 (1)	0.4
ED systolic blood pressure, n (%)			0.02			0.7
>90 mm Hg	972 (88)	565 (85)		535 (88)	527 (87)	
61–90 mm Hg	95 (9)	78 (12)		62 (10)	66 (11)	
≤60 mm Hg	11 (1)	12 (2)		5 (1)	9 (1)	
Missing	27 (2)	8 (1)		8 (1)	8 (1)	
ED pulse, n (%)			0.6			0.97
51–120 bpm	925 (84)	568 (85)		526 (86)	522 (86)	
>120 bpm	156 (14)	85 (13)		76 (12)	78 (12)	
0–50 bpm	7 (1)	4 (1)		3 (1)	4 (1)	
Missing	17 (1)	6 (1)		5 (1)	6 (1)	
Anticoagulant use, n (%)	146 (13)	100 (15)	0.3	85 (14)	87 (14)	0.9

Conclusions

- Different kinds of patient
  - Level 2, keep
  - Level 1, keep
  - Level 2 transfer to Level 1
  - Others (triple jump, Level 3 to Level 1, non-trauma to trauma)
- Analysis
  - Patients were matched for transfer in status
  - Were not matched for type of facility transferred in from
  - 20% of patients were transferred in
- Future
  - May be able to tell who was transferred where

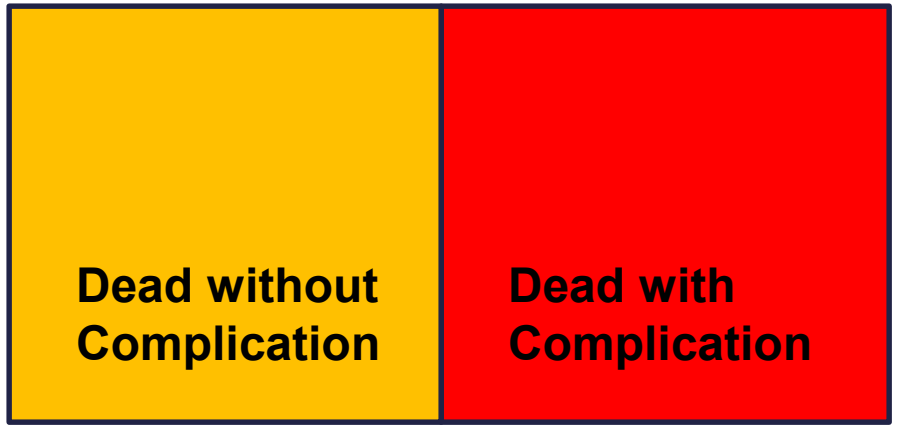
Orthopedic Surgery

- Jim Goulet and Bryant Oliphant
  - Survey (Interest in better coding and involvement)
  - Advisory Committee
  - E-mail
  - Next steps
  - Hip fracture guidelines?
- Isolated Hip Fracture Patients
  - Reviewed codes
  - ACS TQIP
  - Some additional ICD 9/10 codes
    - Diagnosis
    - Procedure
  - Feedback

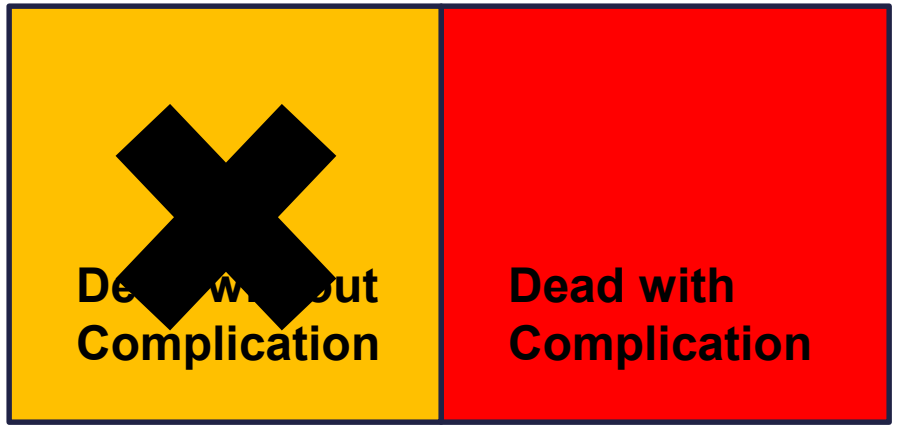
Failure to Rescue

Center 9
Center 23
Center X
Center 10

Failure to Rescue

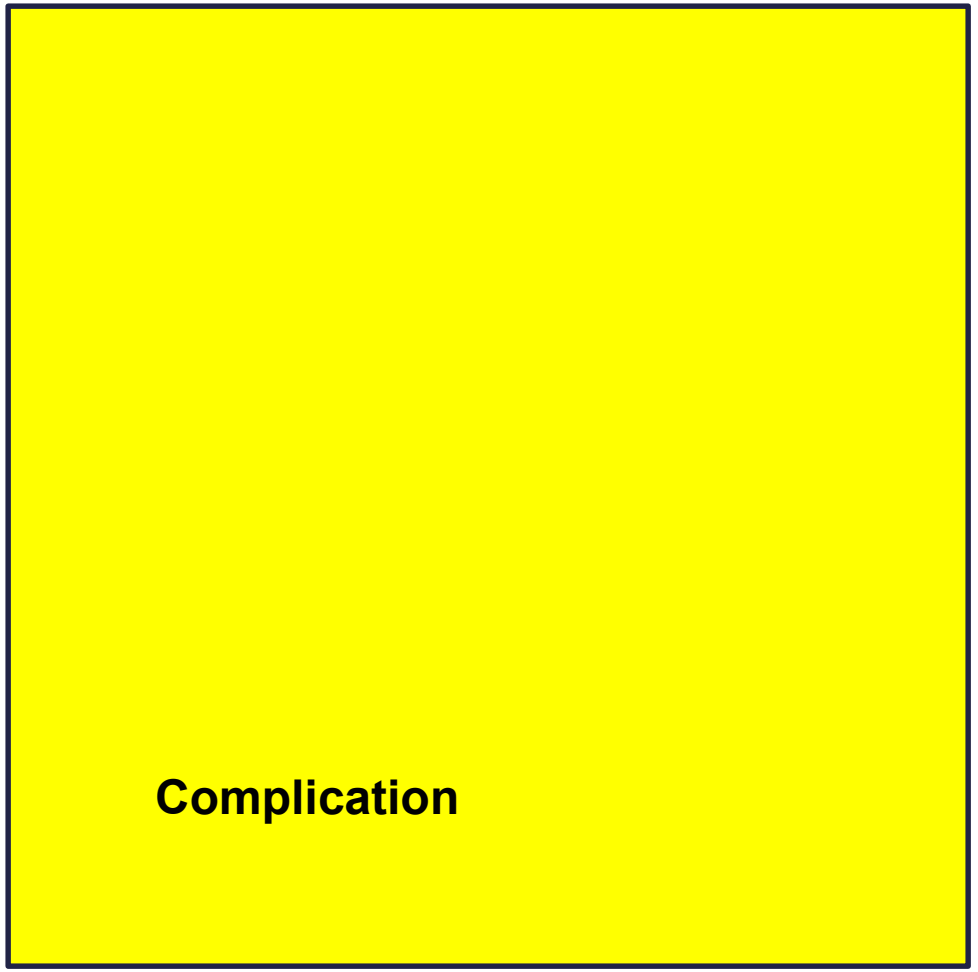


Failure to Rescue



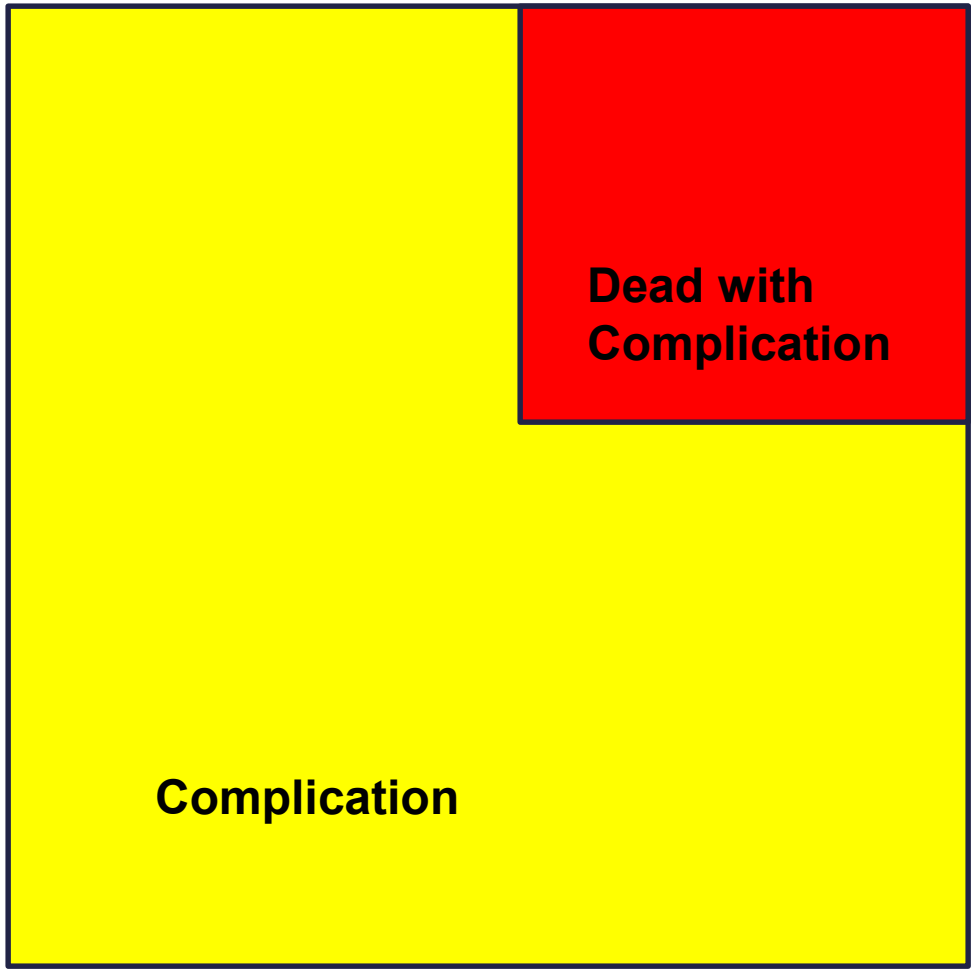
Failure to Rescue

$$\text{Failure to Rescue} = \frac{\quad}{\#\ \text{Complication}}$$

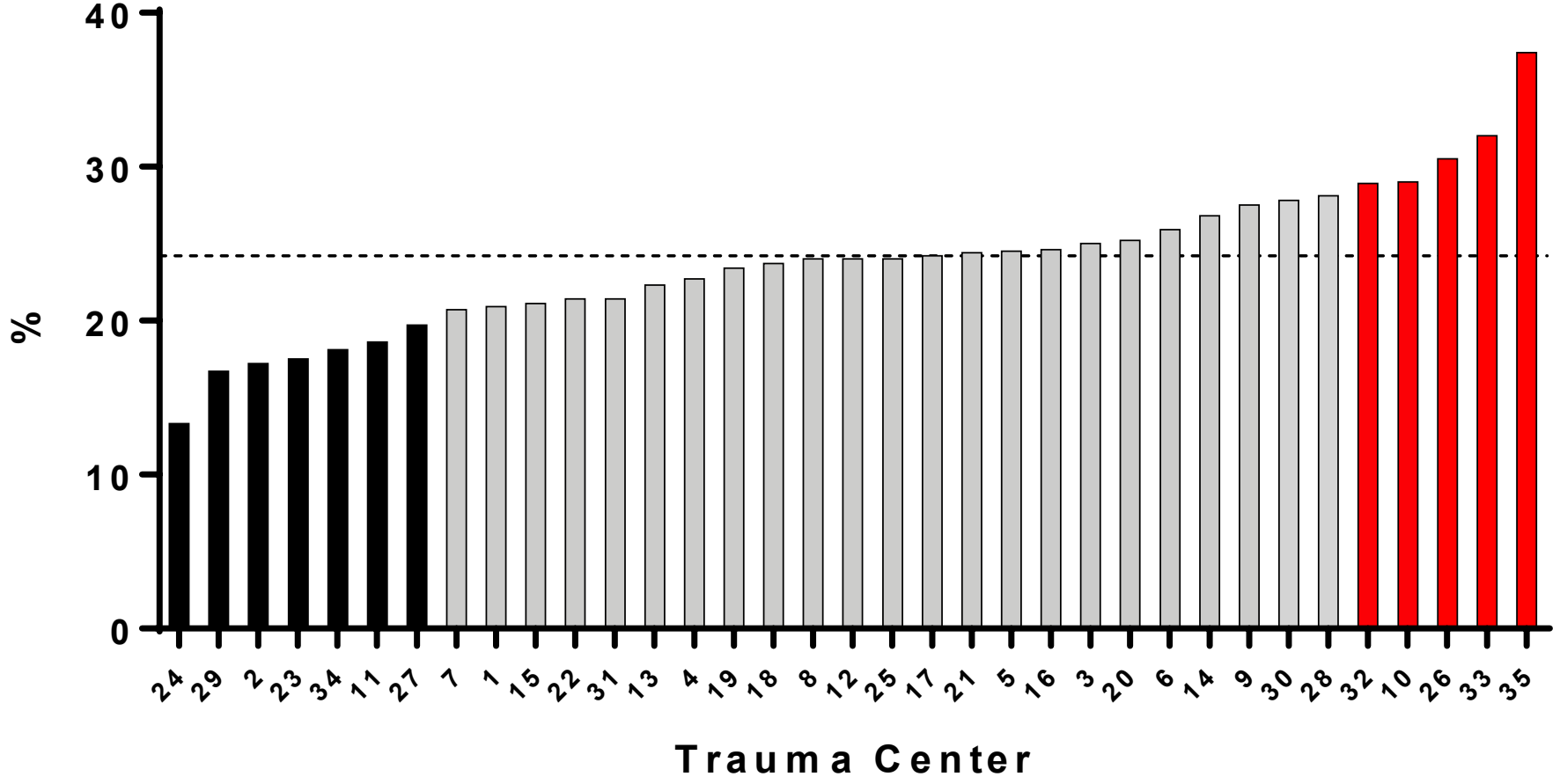


Failure to Rescue

$$\text{Failure to Rescue} = \frac{\#\ \text{Dead w/Comp}}{\#\ \text{Complication}}$$



Failure to Rescue
Cohort 2 - Admit to Trauma



Failure to Rescue

Center 9

Failure to Rescue
Denominator: All cases having serious complication, dead or alive.
Numerator: All cases with mortality, preceded by complication Severity II or III.

Grade II Complications

- Decubitus Ulcer
- DVT: Lower Extremity
- DVT: Upper Extremity
- Enterocutaneous Fistula
- Extremity Compartment Syndrome
- Pneumonia
- PE
- Unplanned Return to OR
- Unplanned Admit to ICU

Grade III Complications

- Acute Lung Injury/ARDS
- Acute Kidney Injury
- Cardiac Arrest with CPR
- Mortality
- Myocardial Infarction
- Severe Sepsis
- Stroke/CVA
- Renal Insufficiency
- Unplanned intubation
- C. Difficile Colitis

Failure to Rescue

Center 9

- Level II Adult Trauma Center
- Service area is 9 counties in MI
- Acute Care Surgery/Trauma Service
  - 5 Attending's with 2 prn taking call
  - Residents in conjunction with WMED
  - 1 Advanced Practice Provider M-F days.

Demographics

- 12 patients from Nov 1, 2015-Jan 31, 2018
- 10 over the age of 65
- 7/12 Palliative Care/Withdrawal of Support
- Ground Level Fall-4
- MVC-6
- Bike vs Car-1
- Assault-1

Drilldown

- This is a very broad data definition
- 3 Categories of patients:
  - True “Failure to Rescue”…critical systems or personnel failures (Cat. 1)
  - General categories of decline possibly indicating a blind spot in your system (Cat 2)
  - Clear palliative or “end of life” care without the ability to rescue, despite the premorbid identification of a severe complication (Cat 3)

Drilldown II

- Of those 12 patients,

  1 Cat 1

  5 Cat 2

  6 Cat 3

Category 1 patient

- Elderly woman t-boned on drivers side brought hypotensive to ED with pelvic fracture, transient responder, diagnosed rapidly, taken to IR.
- Both trauma staff surgeon and ED resuscitative nurse left IR suite. IR nurse removed binder in haste as patient was declining; lost pulses, died.

Category 2

- Elderly anticoagulated pt with multiple comorbidities admitted to ICU with small subdural, reversed with 2 U FFP and Vit K, transferred stable to floor, PEA arrest on floor HD day 3.

Category 3

- Severely demented elderly pt GLF at AFC with small intraventricular hemorrhage. ICU, then floor. Severe aspiration/dysphagia, pneumonia diagnosed HD 2, declined on floor, returned to unit. Family requested comfort care only after discussion/clarification of goals of care with attending staff.

Why are we at this Status?

- We have a very low major complication rate within the collaborative, and mortality rate is on the high end.
- Nature of the cases and the philosophy with which our team handles them as noted previously

What we do well

- Well developed Palliative Care Program
- Acute Care Surgery Team comfortable initiating a conversation about end of life care
- Start conversations early with patients and family about long-term prognosis

Opportunities Identified

- Clarified the process of who follows with patients to ancillary departments for procedures.
- Clarified roles of nursing and physician staff in ancillary departments.
- I personally, and our attending staff learned some lessons about team management and situational awareness

How do we Sustain the Change

Review all charts that require patient going to ancillary departments.

- TPM attends trauma activations.

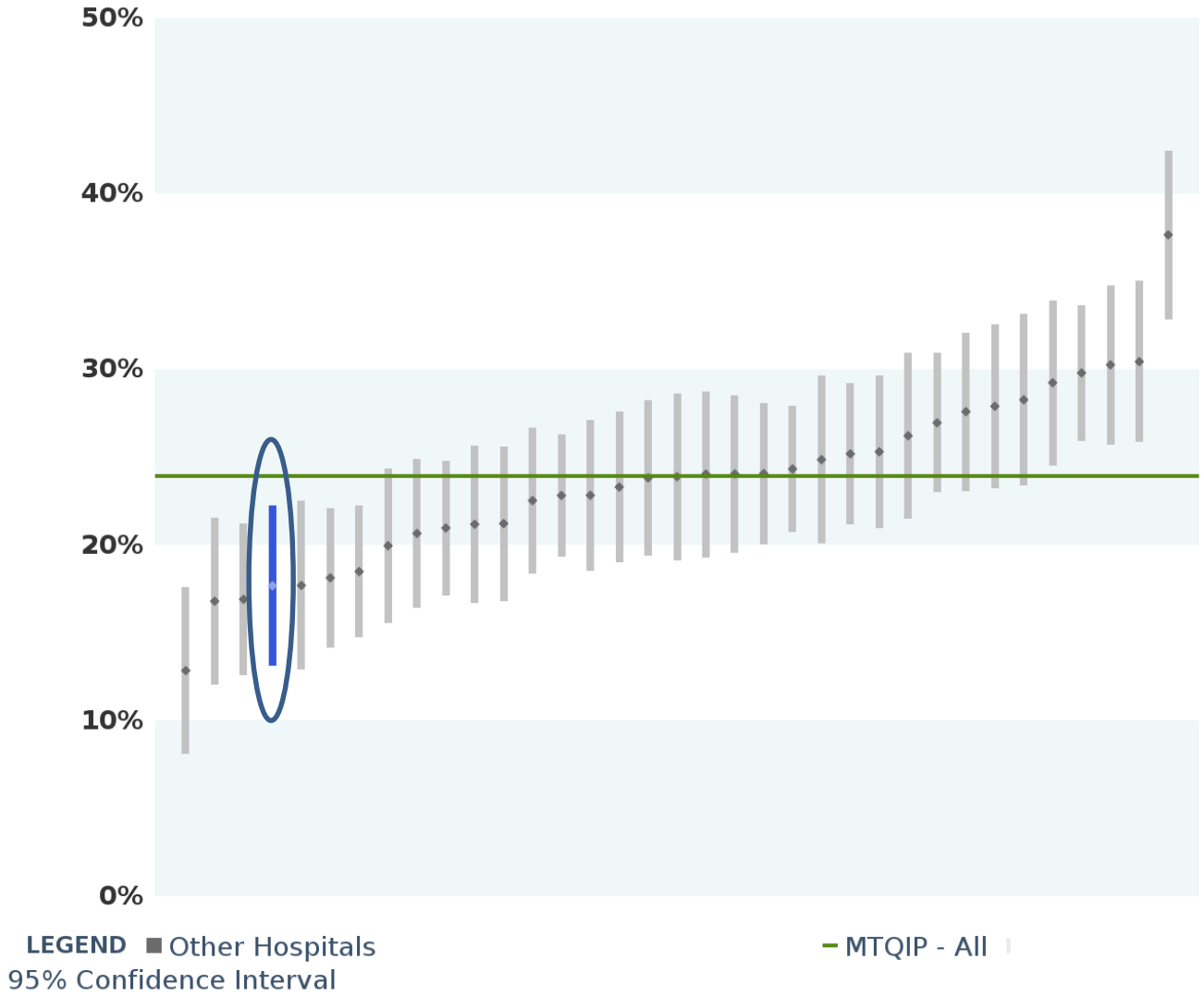
Moving Forward

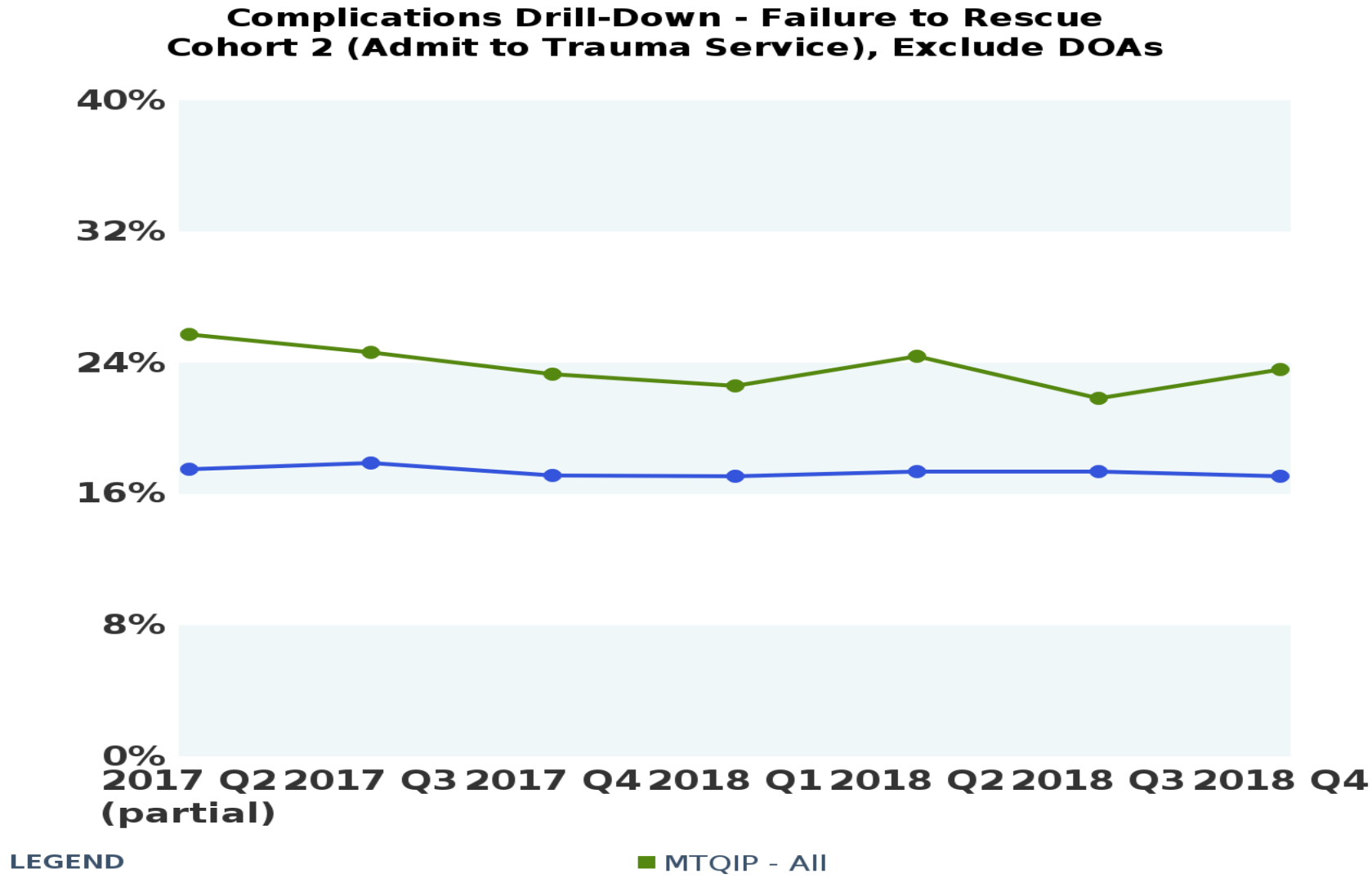
- Continue monitoring of ED process for Tier 1 (Full activation) patients
- Continue to use this tool to identify my Category 2 patients to identify any patterns of failure not identified through our routine PI process.
- Surgeons and program staff also need to be paying attention to patterns, e.g.: hips.

Failure to Rescue

Center 23

Complications Drill-Down - Failure to Rescue
Cohort 2 (Admit to Trauma Service), Exclude DOAs, Last 24 Months




Complications Drill-Down - Failure to Rescue
Cohort 2 (Admit to Trauma Service), Exclude DOAs
40%
32%
24%
16%
8%
0%
2017 Q2 (partial)
2017 Q3
2017 Q4
2018 Q1
2018 Q2
2018 Q3
2018 Q4
LEGEND
MTQIP - All

Center 23

- Level II Adult-Only
- Region
- Geriatric: Falls & Motor Vehicle Crashes
- 1350 Cases Annually

Trauma Service

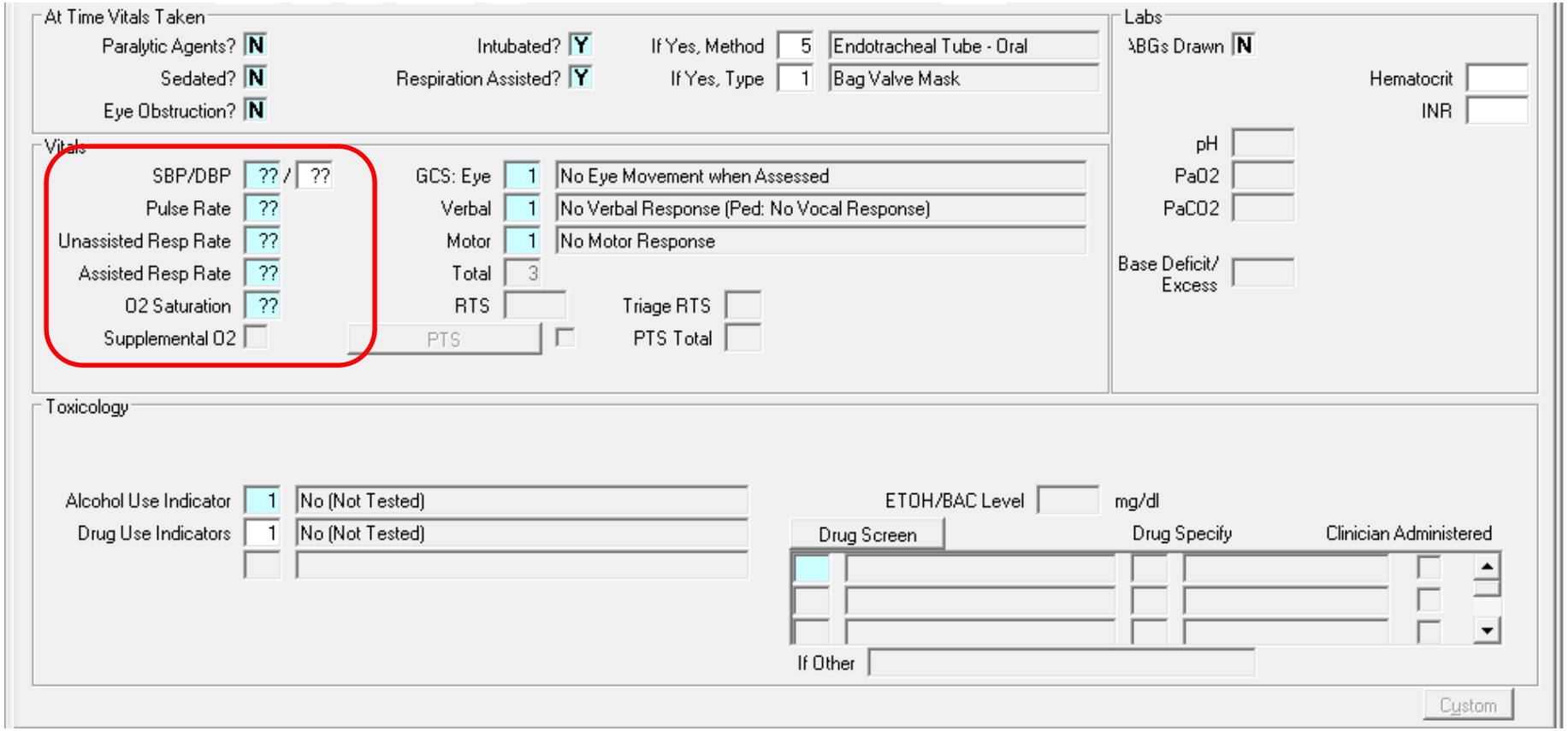
- Five (5) call panel, in-house surgeons 24/7.
- Two (2) Surgical Intensivists.
- General Surgical resident assigned monthly.
  (ACGME/MSU)
- Trauma Nurse Coordinators (01/16).

Failure to Rescue: 10/41

(24% unadjusted/ 18% adjusted)

- **Average Age**: 65
- **Average ISS**: 25
- **CPR -Field/Scene/Enroute/ED**: 3/10 (30%)
- **Cardiopulmonary Complication**: 7/10 (70%)

Data concern



“**Rescued**”: n=41

- **Average Age:** 66
- **Average ISS**: 19
- **CPR (Field/Scene/En route/ED):** 3/41 (7%)
- **Cardiopulmonary Complication:** 28/41 (68%)

Low Outlier: Reasons

- **Validated Data:** Two (2) consecutive five (5) star data validations.
- **Consultants:** Geriatrics, Palliative Care and Hospice
- **Trauma Nurse Coordinators (TNC):** Added first in January 2016, second 2018
- **Management:** Once complication identified-aggressive management.

What We do Well

- **Consultants:** Geriatrics, Palliative Care and Hospice

Moving Forward

- **Pneumonia Complication**:
  - ✓Drill down & identify opportunities
  - ✓Should improve Failure to Rescue & Pneumonia

- **Staff Adds (Sustain & Improve):**
  - ✓ Additional 1.0 FTE-Trauma Nurse Coordinator
  - ✓2.0 FTE Advanced Practice Providers

- Adherence to definitions and quality data.

Failure to Rescue

About our facility…

- ACS verified Level II Adult Trauma Center

- Volume: 1000 trauma registry patients
  - 800 patients meet MTQIP inclusion criteria
  - 570 patients admitted to trauma service
  - 54% patients ≥ 65 years of age
  - 96% blunt MOI

- Composition of trauma service:
  - 6 trauma call surgeons
  - Consistent trauma service physician coverage 1 week at a time
  - Daily APP coverage 7a-5p, new nightshift APP coverage started 3/2018

Failure to Rescue Status

Failure to Rescue

- Step # 1 understanding the definition…
- Exclude DOA

$$\frac{\text{All deaths, admitted to trauma, ISS} \geq 5\text{, that had grade 2 or 3 complication}}{\text{Total Patients with Grade 2 or 3 Complications}}$$

Failure to Rescue Drill Down

Overall mortality and complications-not a high outlier, why failure to rescue??

- 18 patients included in FTR cohort
  - 3 patients died in ED
  - 15 patients admitted
    - 53% > 65
    - 12 patients withdrawal of care
- Clarify Data definitions:
  - 1 patient did not meet inclusion criteria-arrived without signs of life BP=0, HR=0, GCS=3. Clarification on registry data capture.

Failure to Rescue Drill Down

- Common trends/themes?

Mortality Review:

- Withdrawal of care- was it related to complication vs injury?
- Provider / process issues?

Complication Review:

– Ventilator Associated Pneumonia: 4 patients

- Hospital wide PI project to decrease VAE
  - Ventilator Protocols focused on decreasing VAE
  - Standardization of nursing/ RT care

Failure to Rescue

Conclusion…

- No “Smoking Gun” or overwhelming trend that contributed to our FTR rates.
  - Small volume makes it difficult to identify trends
- FTR is beneficial as a secondary audit filter for a high level overview for trends in complications/ mortality, and overall PI process.
    - VAP identified as a complication that needs addressed
    - Monitor provider trends

Questions??

About Us

Center 10

- ACS Verified Level I Adult and Level II Pediatric Center
- ED Volume 120,000 annually
- Trauma registry volume 2500 annually
  - Blunt: 80%
  - Penetrating: 18%
  - Burn: 2%

About Us

Center 10

- 10 Attending surgeons taking call
- Numerous residency and fellowship programs
- Trauma Service- Resident run with 1 MLP on days/ 1 MLP on nights
  - Trauma Program Manager
  - 5 registrars
  - 2 MCRs
  - Pediatric Coordinator
  - Injury Prevention coordinator
  - Administrative assistant

Definition

Failure to Rescue

- Age ≥16
- ISS ≥ 5
- Hospital LOS ≥ 1 day or dead
- Exclude DOA
- Admit to trauma service (Cohort 2)
- Patients with Grade 2 or Grade 3 Complication
- Failure to rescue = n dead with complication / n with complication

Definition

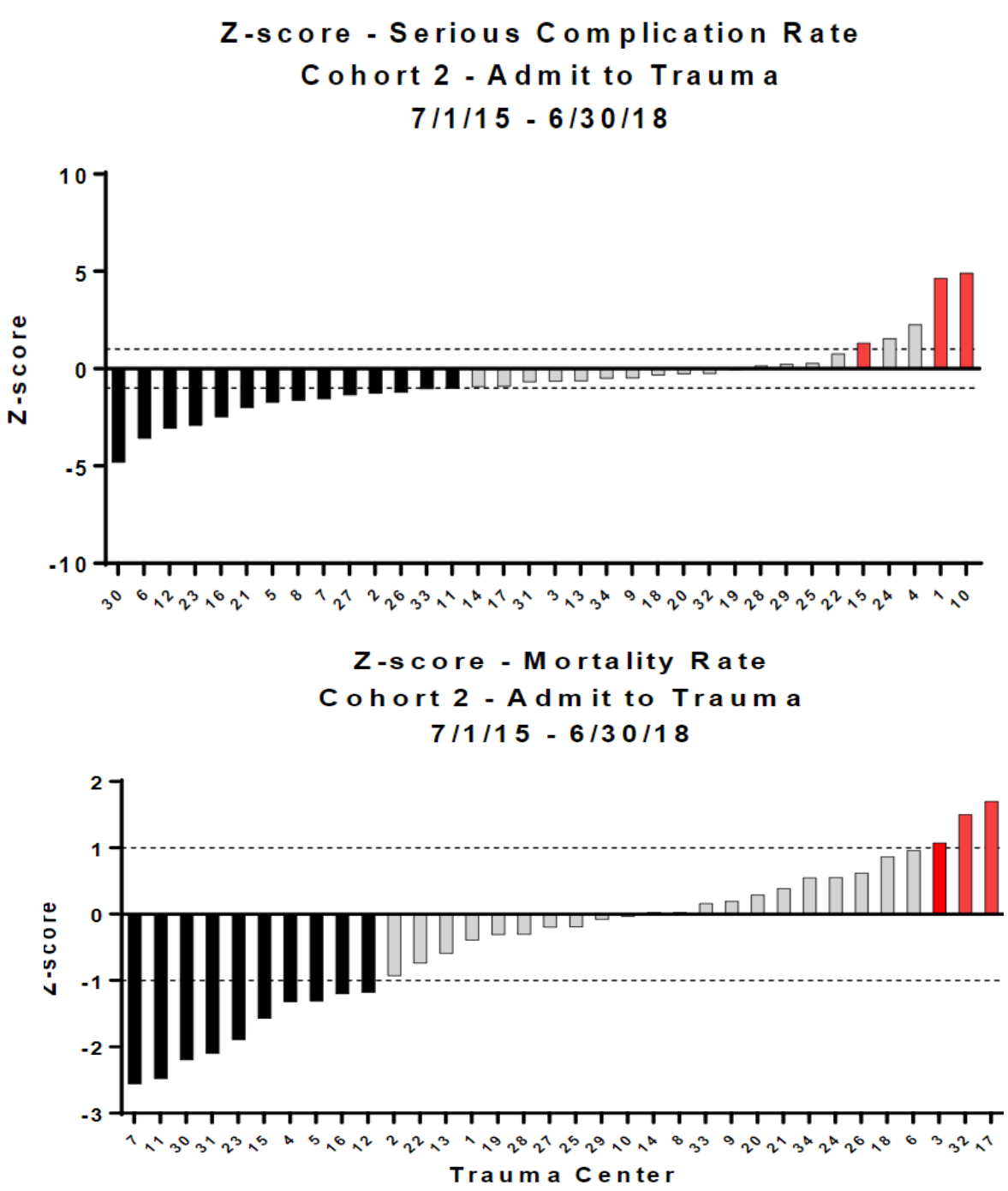
Failure to Rescue

Grade 2 Complications	Grade 3 Complications
• Unplanned ICU admit • Pneumonia • Unplanned return to OR • DVT/PE • Decubitus ulcer • Cdiff. • Enterocutaneous fistula • Extremity compartment syndrome	• Cardiac arrest with CPR • Acute Kidney Injury • ARDS • Myocardial Infarction • Unplanned Intubation • CVA • Severe Sepsis • Acute Renal Insufficiency • Mortality

Failure to Rescue Status

Center 10

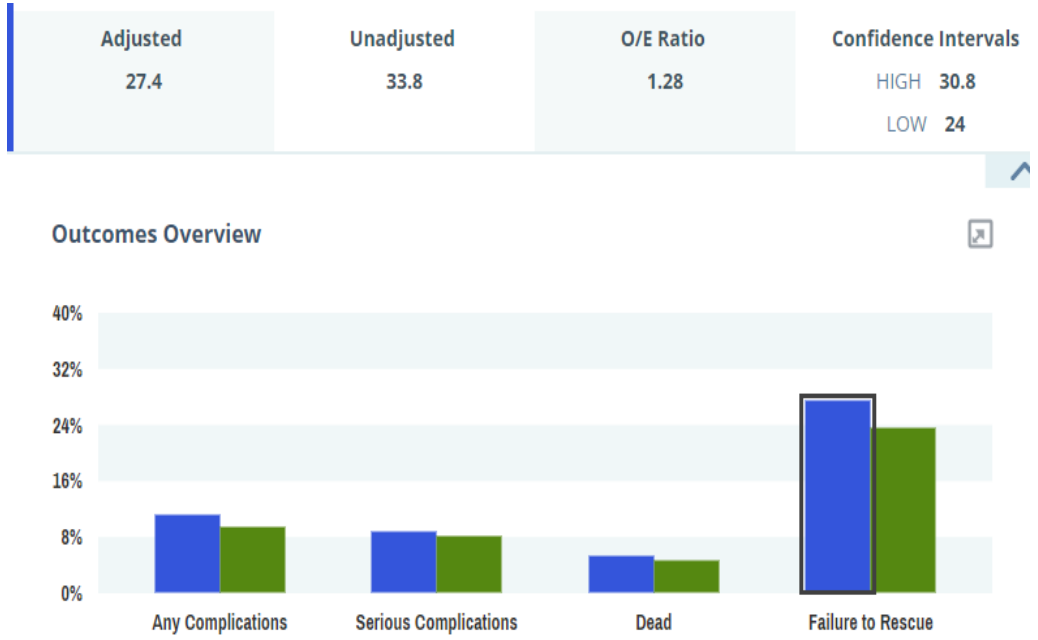
- Serious complication Z score has increased (high outlier)
- Mortality rate Z score has remained consistent (average performance)
- Addition of 1st MCR 04/2016
  - 2nd MCR 01/2018

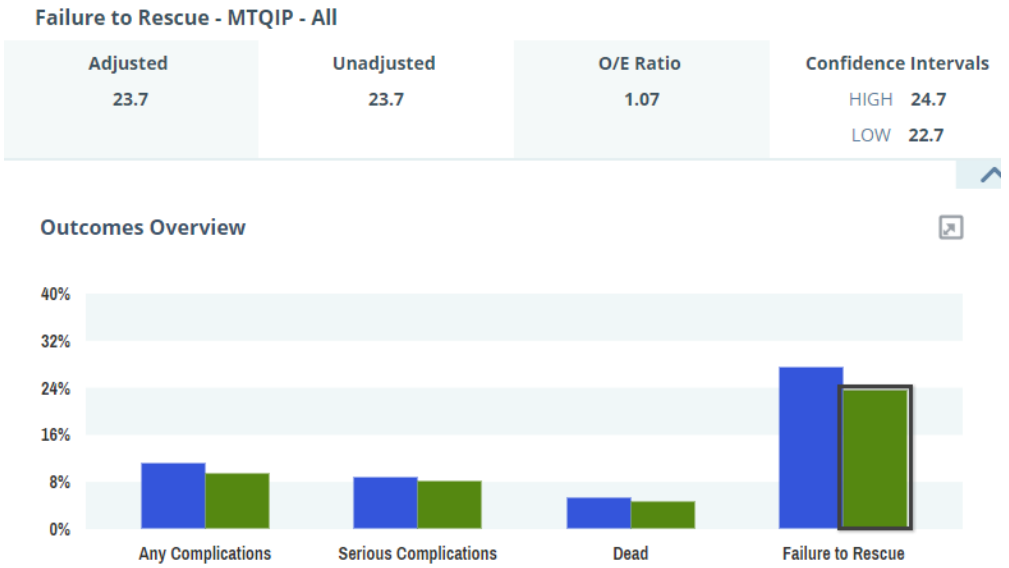


Failure to Rescue Status

Center 10

- July 1, 2015-December 31, 2018
- ASJH Adjusted FTR rate: 27.4%
- MTQIP Adjusted FTR rate: 23.7%





Drilldown

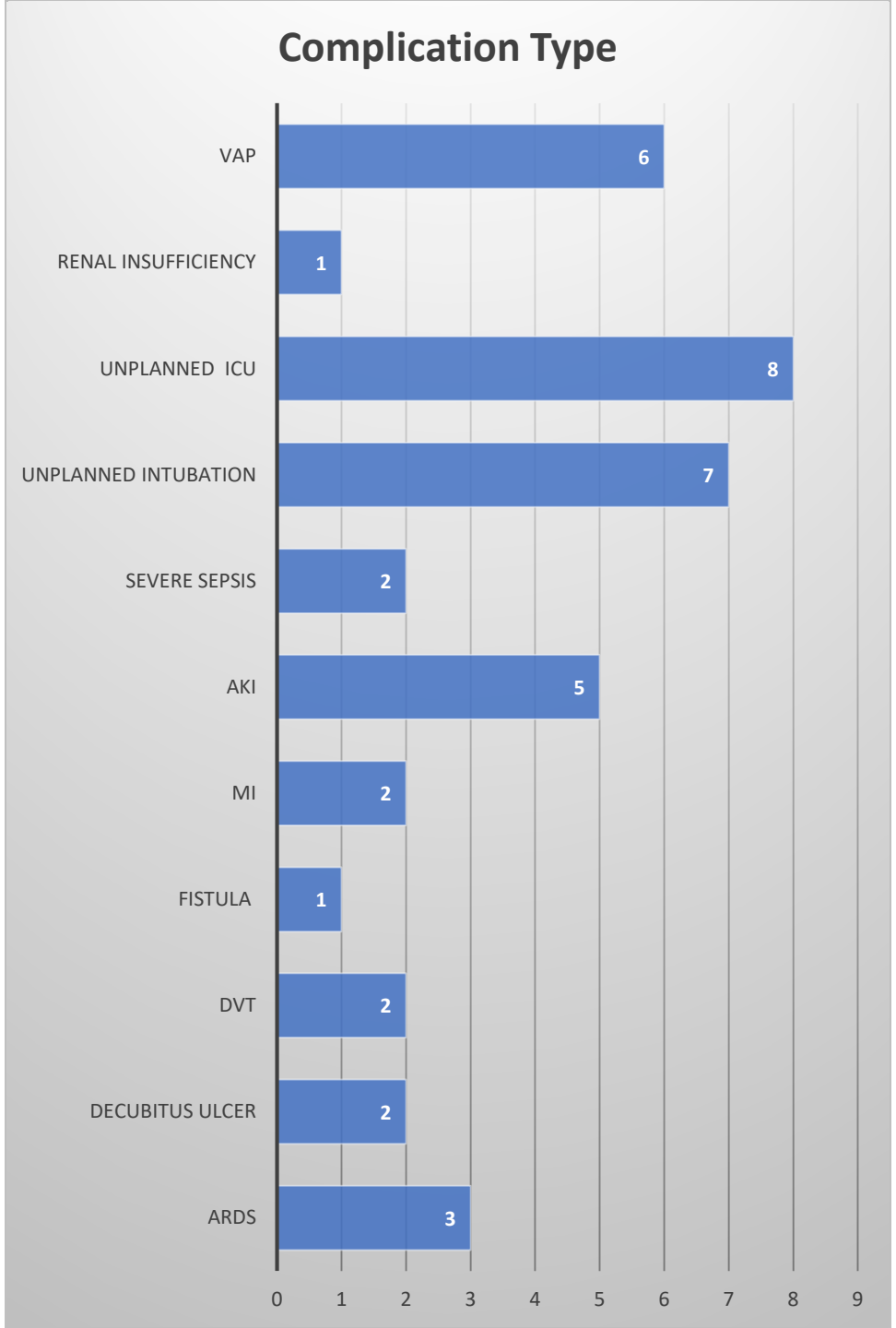
- 70 patients identified
- Average ISS 26.2
- Average age 56.9 years
- Blunt 65% (45)
- Penetrating 35% (25)

Center 10

- Out of 70 patients identified, **52** had CPR as one of the complications.

- Of the 52 patients with CPR
  - 54% Blunt
  - 46% Penetrating

- 41 of the 52 (**79%**) had CPR within 1 day of arrival.
  - Average ISS: 33.4
  - Average Age: 43.5
    - Of the 41 patients
      - 56% Penetrating, Avg. age 36, Avg. ISS 28
      - 44% Blunt, Avg. age 53, Avg. ISS 41



Failure to Rescue Status

Center 10

- 18 patients were identified as having no CPR but other complication(s)
  - Average ISS: 14.5
  - Average Age: 81.2 years
    - Blunt: 94%
    - Penetrating: 6%
- Unplanned ICU: 44%
- Unplanned intubation: 39%

Reasons

- Collecting complications more accurately since the addition of MCRs.
- Despite complication rate increasing, mortality rate has remained the same.
- 79% of patients had an episode of cardiac arrest within Hospital Day 1
- Geriatric trauma

Moving Forward

- Opportunities for a more robust drilldown into FTR
  - Patients with CPR greater than Hospital day 1
  - Patients with multiple complications

- Geriatric Trauma Protocols
  - Early Geriatrician Consults
  - ICU admission
  - Aggressive pulmonary toilet
    - Early tracheostomy

- Palliative care consults

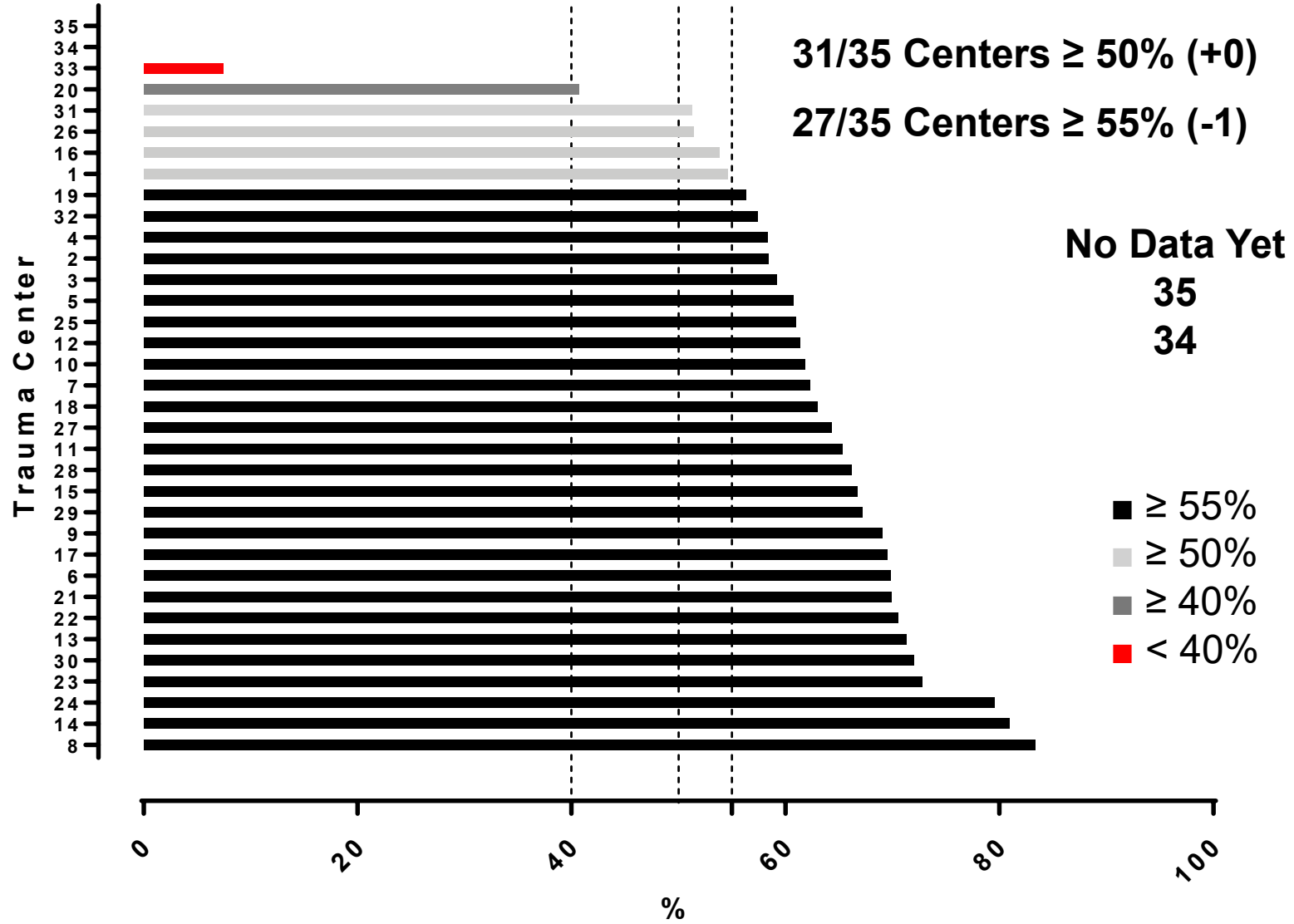
MTQIP Data

Mark Hemmila, MD

#4 VTE Prophylaxis Initiated ≤ 48 hrs

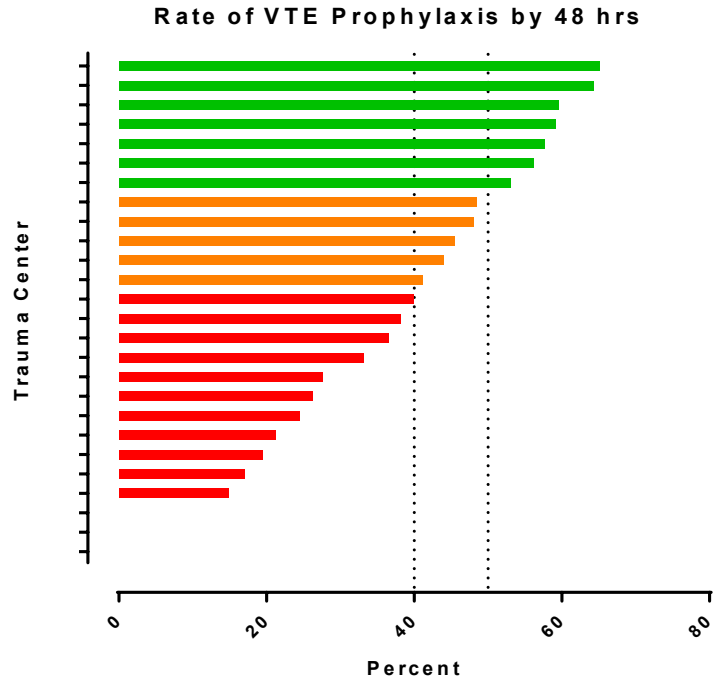
- Venous Thromboembolism (VTE) Prophylaxis Initiated Within 48 Hours of Arrival in Trauma Service Admits with > 2 Day Length of Stay (18 Mo's: 1/1/18-6/30/19)

VTE Prophylaxis Timing <= 48 hrs
Cohort 2 - Admit to Trauma
1/1/18 - 1/31/19



#4 VTE Prophylaxis Initiated ≤ 48 hrs

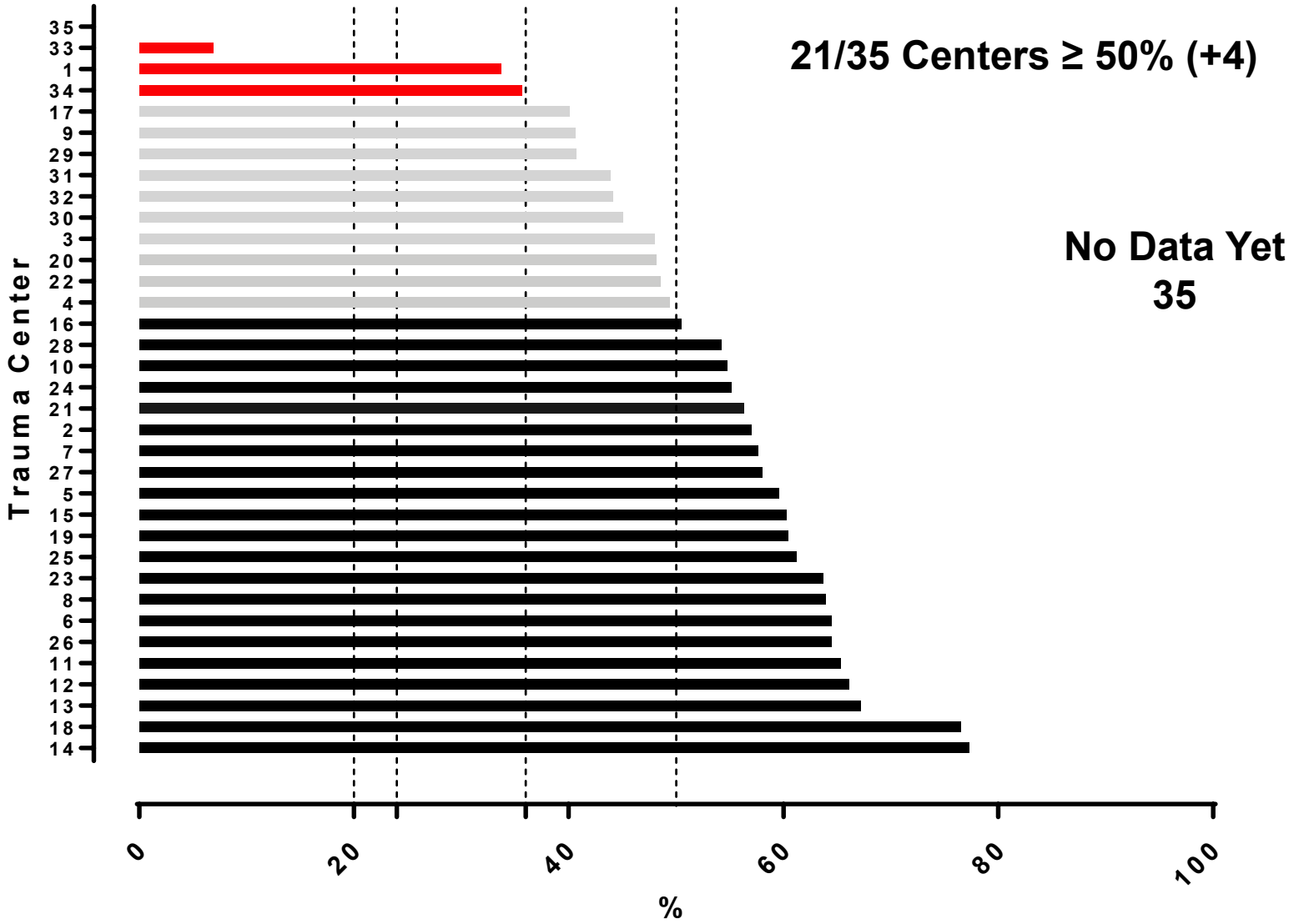
- Hospital Target ≥ 55% = 10 points
- CQI Target 80% of hospitals ≥ 55%
  - 27/34 hospitals (79%)
  - May 2014: 7 > 50%
  - Jan 2015: 31 > 50%



#5 VTE Prophylaxis with LMWH

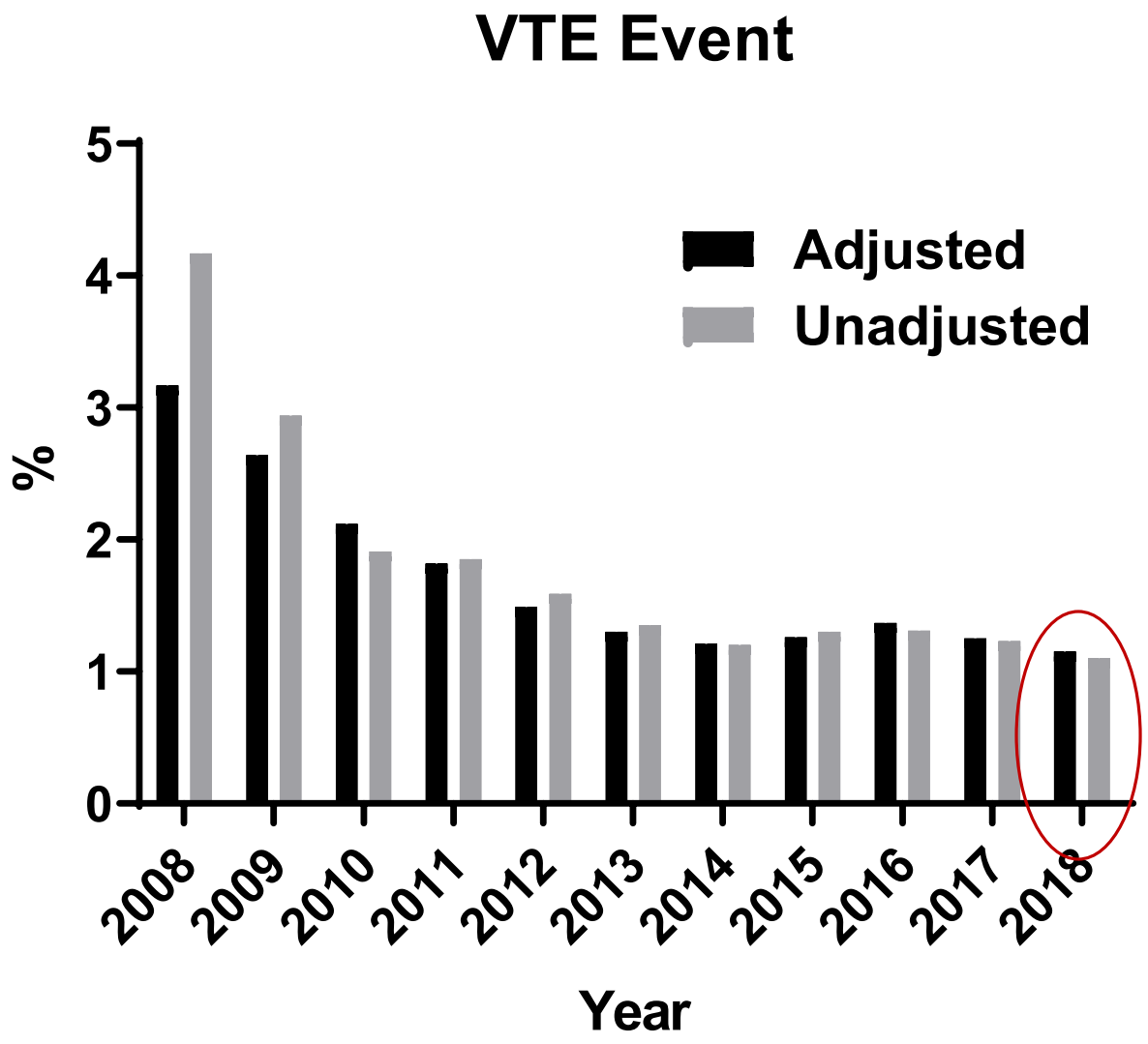
- Low Molecular Weight Heparin (LMWH) Venous Thromboembolism (VTE) Prophylaxis Use in Trauma Service Admits (18 Mo's: 1/1/18-6/30/19)

VTE Prophylaxis Type - LMWH
Cohort 2 - Admit to Trauma
1/1/18 - 1/31/19



21/35 Centers ≥ 50% (+4)

No Data Yet
35


VTE Event
5
4
3
2
1
0
%
Adjusted
Unadjusted
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Year

Combine #4 and #5 into One Measure ?

- Venous Thromboembolism (VTE) Prophylaxis Initiated Within 48 Hours of Arrival in Trauma Service Admits with > 2 Day Length of Stay
- And
- Low Molecular Weight Heparin (LMWH) Venous Thromboembolism (VTE) Prophylaxis Use in Trauma Service Admits

- Collaborative Mean = 50%

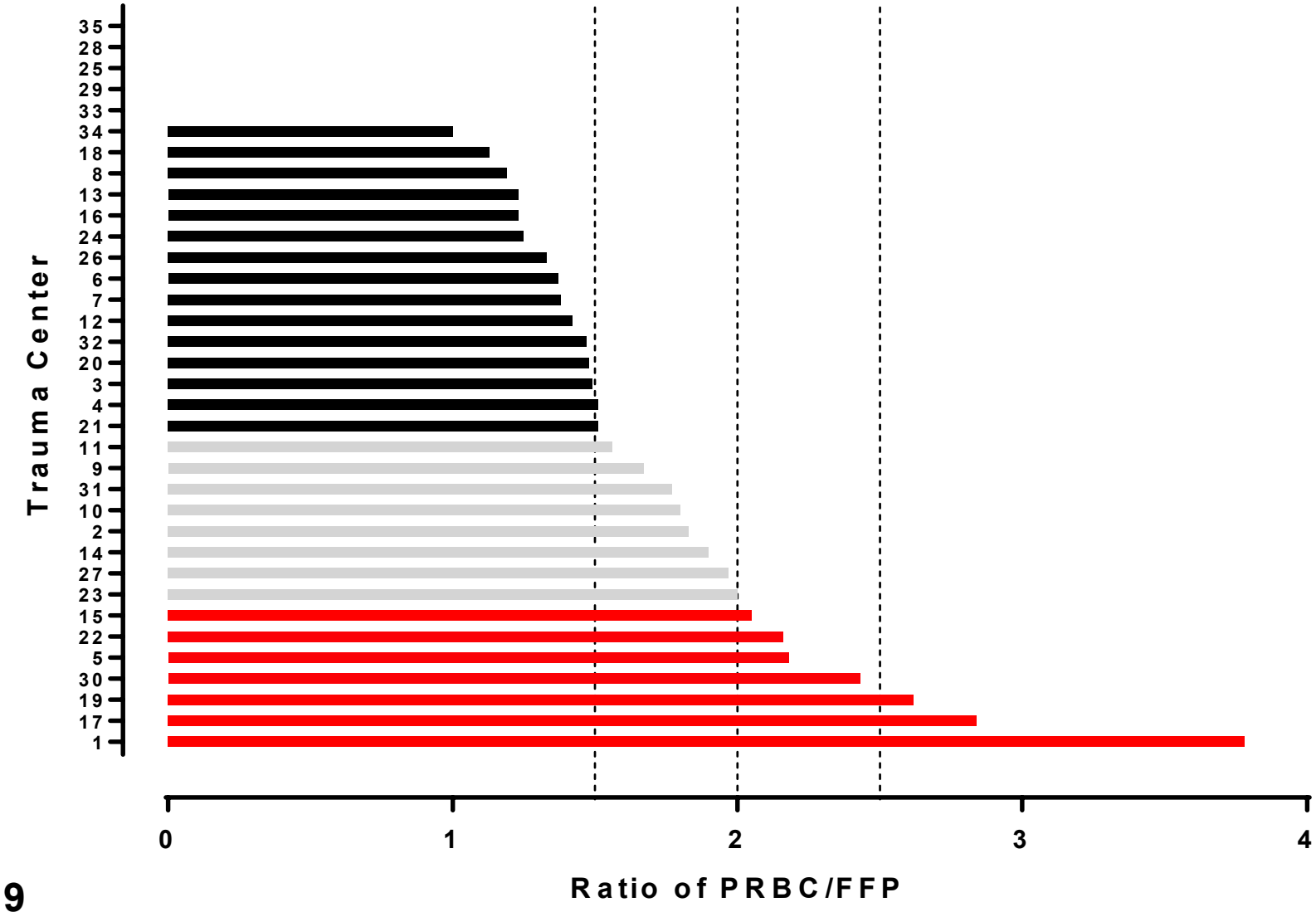
#6 Red Blood Cell to Plasma Ratio

- Red blood cell to plasma ratio (weighted mean points) of patients transfused ≥5 units in first 4 hours (18 Mo's: 1/1/18-6/30/19)

Blood Product Ratio in first 4 hrs if >= 5 uPRBCs

Cohort 1 - MTQIP All

1/1/18 - 1/31/19



Questions

- How to standardize
  - Blood and FFP in ED, amount, ratio ?
  - What order to give ? Who controls ?
  - How do you turn on MTP ?
  - How do you turn off MTP ?
  - Handoff to anesthesia ?
- Has anyone taken out of the Surgeon/Resident hands ?
- ROTEM, TEG ?

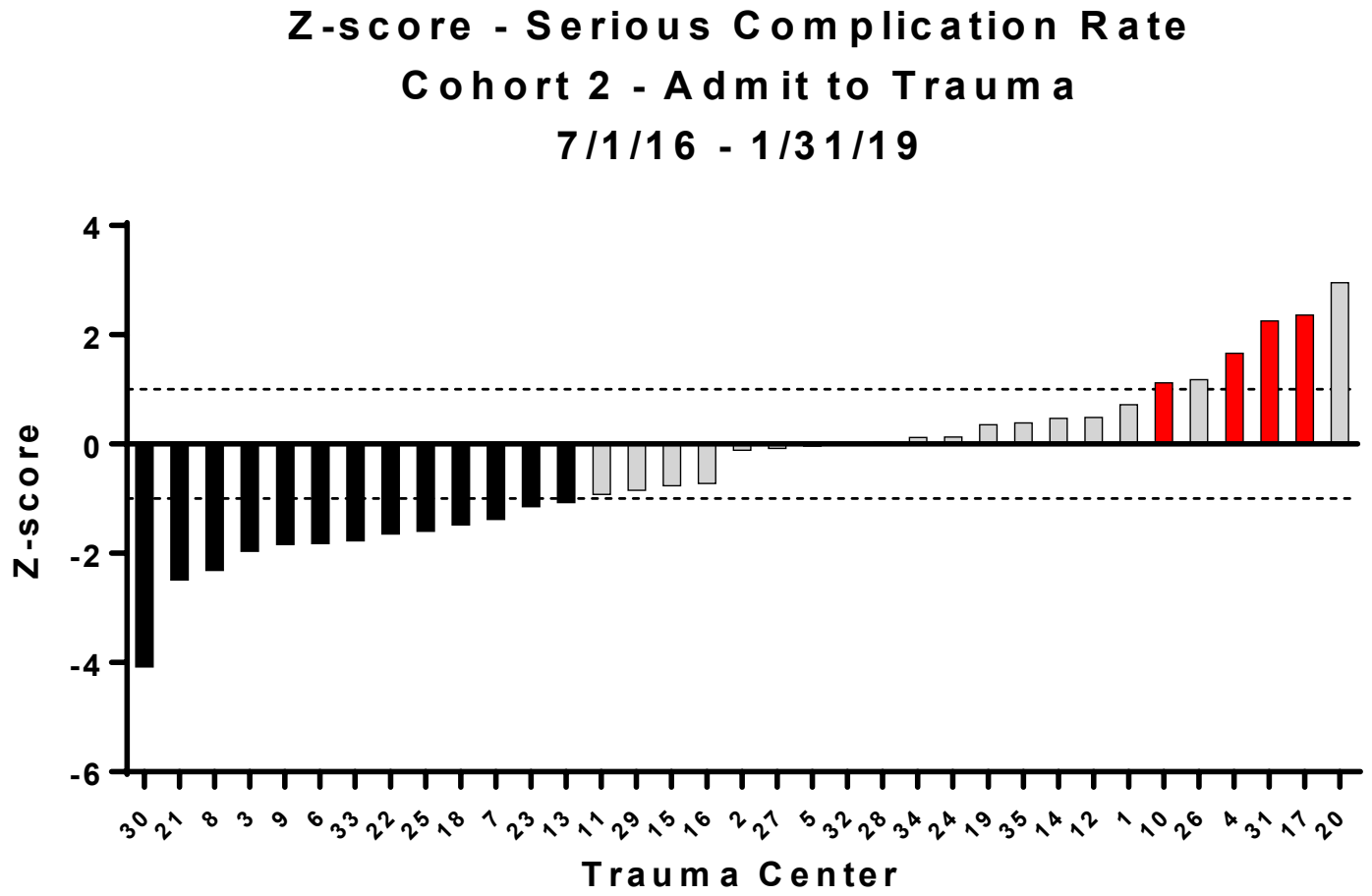
#7 Serious Complications

- Serious Complication Rate - Trauma Service Admits (3 years: 7/1/16-6/30/19)

Z-score

- Measure of trend in outcome over time
- Hospital specific
  - Compared to yourself
- Standard deviation
- > 1 getting worse
- 1 to -1 flat
- < -1 getting better

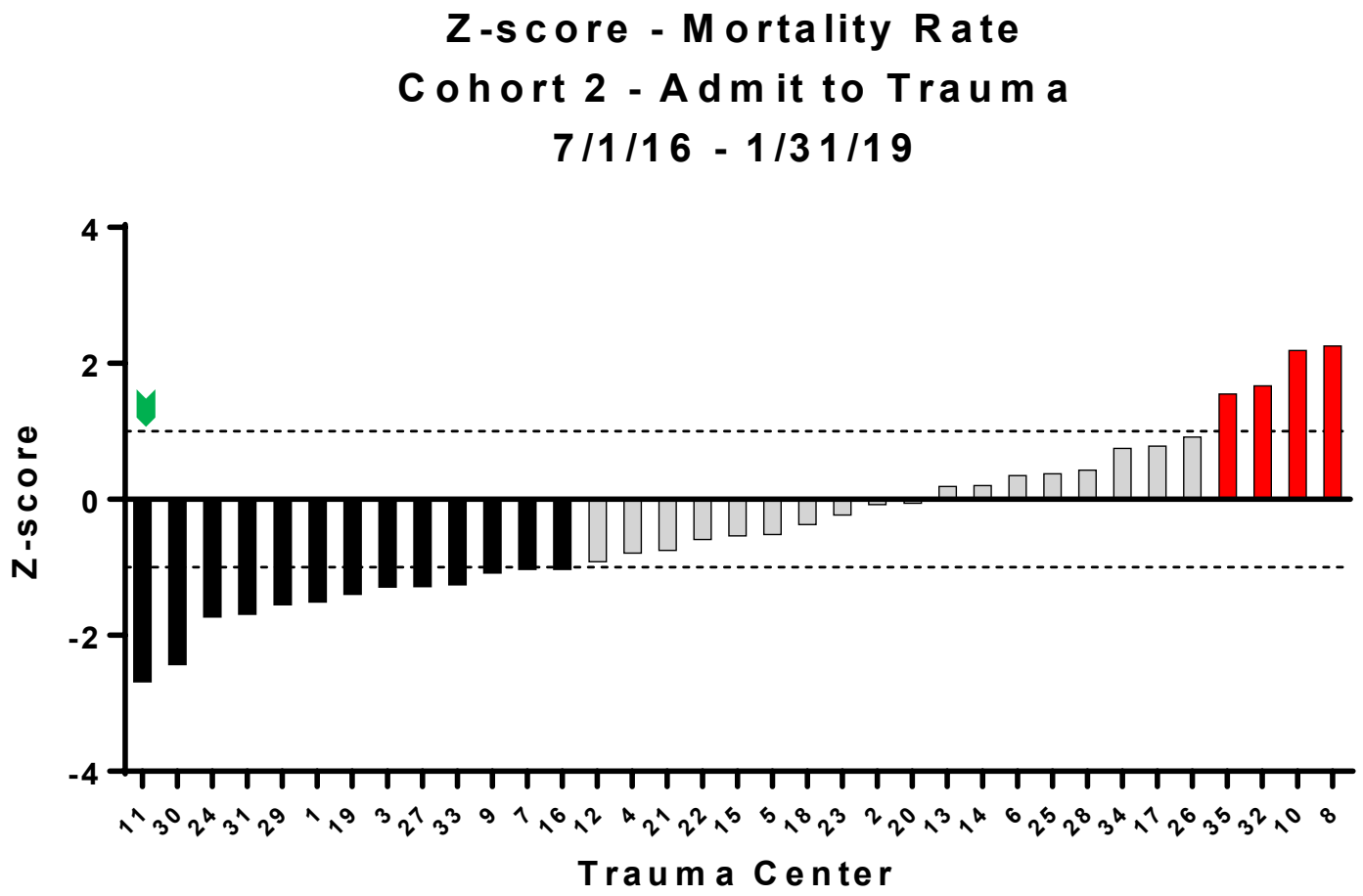
#7 Serious Complication Rate (Z-score)



#8 Mortality

- Mortality Rate - Trauma Service Admits (3 years: 7/1/16-6/30/19)

#8 Mortality Rate (Z-score)



#9 Open Fracture Antibiotic Usage

- Type of antibiotic administered along with date and time for open fracture of femur or tibia
- Presence of acute open femur or tibia fracture based on AIS or ICD10 codes (See list)
- Cohort = Cohort 1 (All)
- Exclude direct admissions and transfer in
- No Signs of Life = Exclude DOAs
- Transfers Out = Include Transfers Out
- Time Period = 7/1/18 to 6/30/19

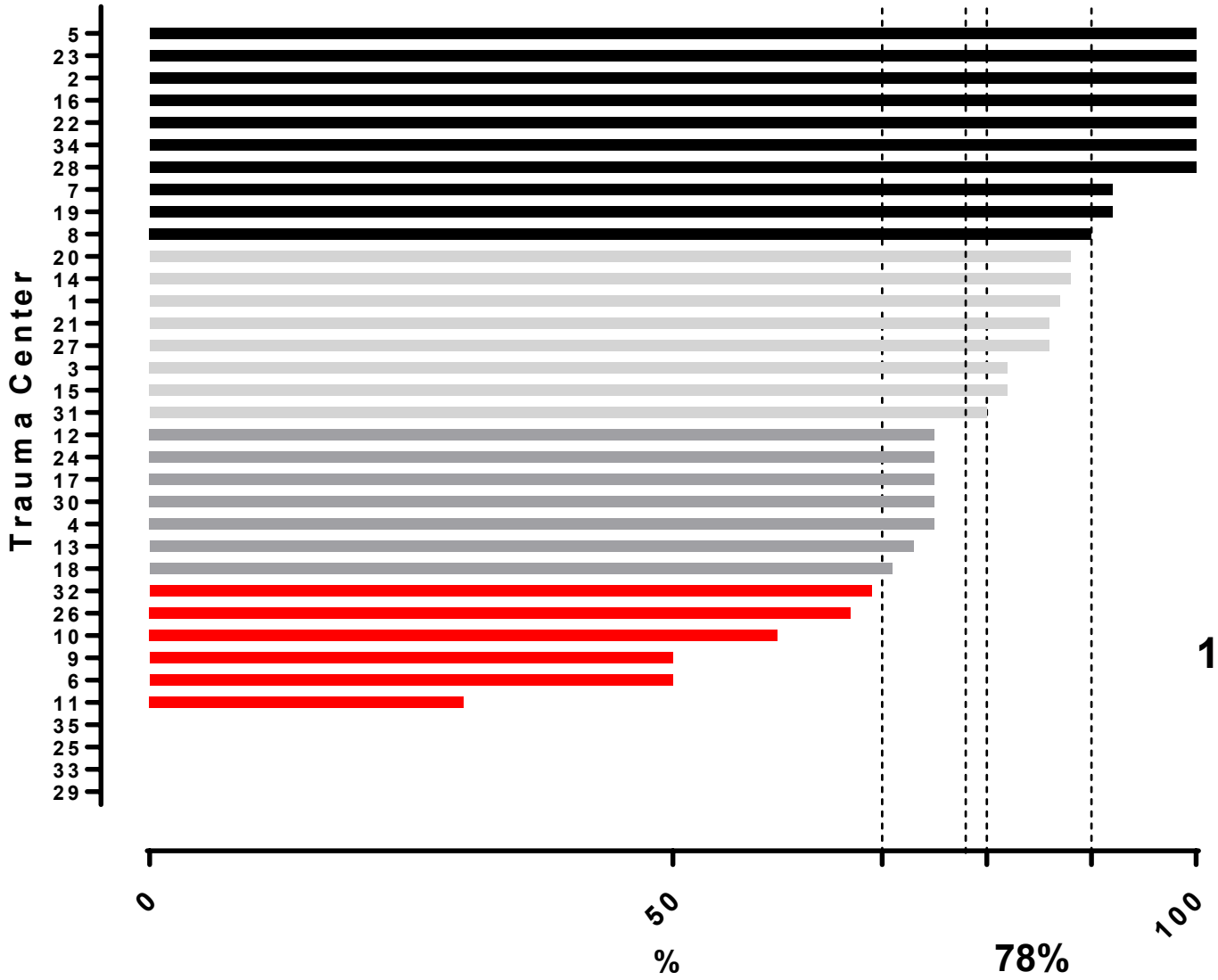
#9 Open Fracture Antibiotic Usage

- ACS-COT Orange Book – VRC resources
  - Administration within 60 minutes
    - ACS OTA Ortho Update
    - ACS TQIP Best Practices Orthopedics
- Measure = % of patients with antibiotic type, date, time recorded and ≤ 120 minutes

Open Fracture - Time to Abx ≤120 min

Cohort 1 - MTQIP All

7/1/18 - 1/31/19



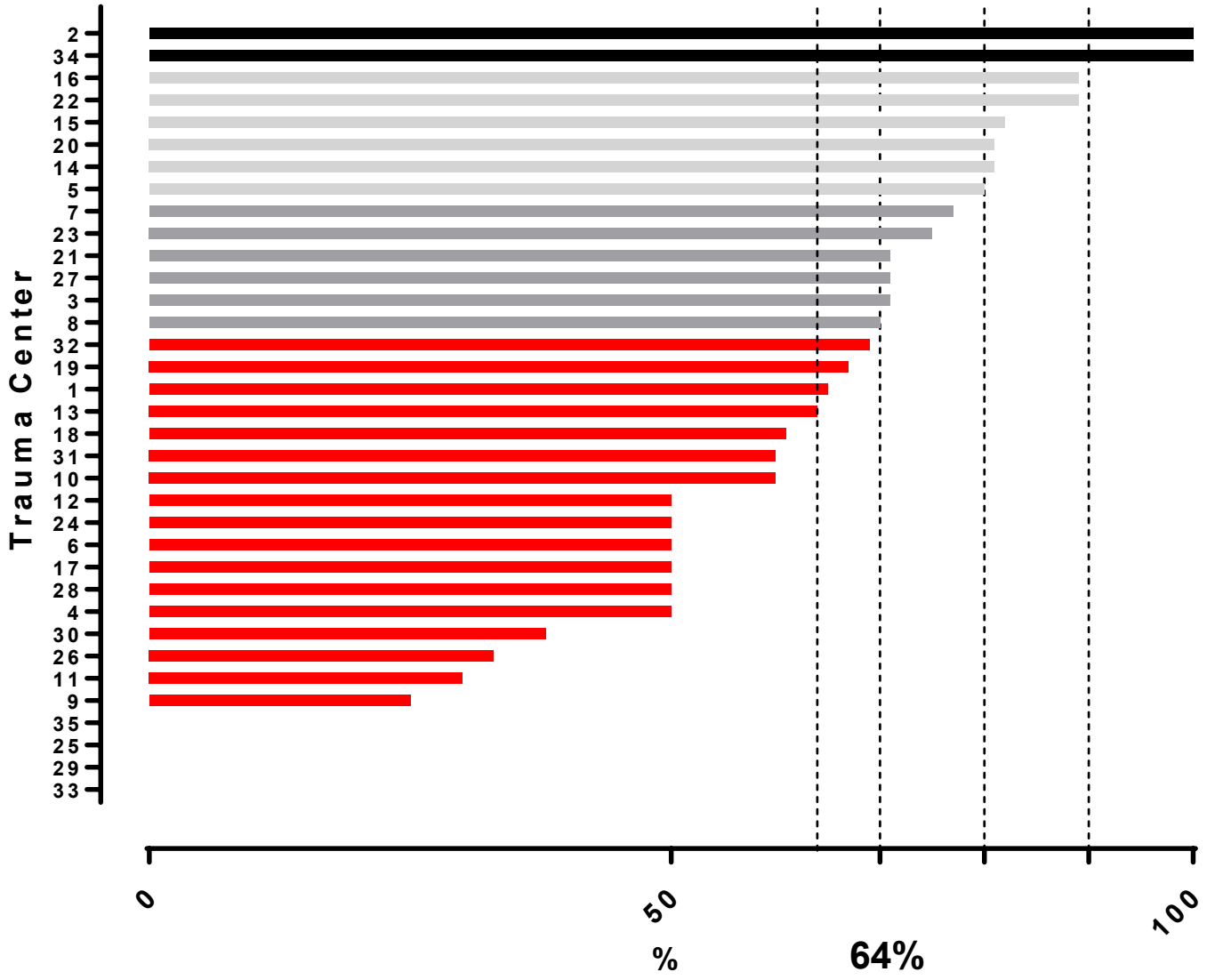
10/35 Centers ≥ 90% (-16)

78%

Open Fracture - Time to Abx ≤ 60 min

Cohort 1 - MTQIP All

7/1/18 - 1/31/19



64%

#10 Head CT Scan in ED on patient taking anticoagulation medication with TBI

- Head CT date and time from procedures
- Presence of prehospital anticoagulation or anti-platelet use
- TBI (AIS Head, excluding NFS, scalp, neck, hypoxia)
- Cohort1, Blunt mechanism
- Exclude direct admissions and transfer in
- No Signs of Life = Exclude DOAs
- Transfers Out = Include Transfers Out
- Time Period = 7/1/18 to 6/30/19

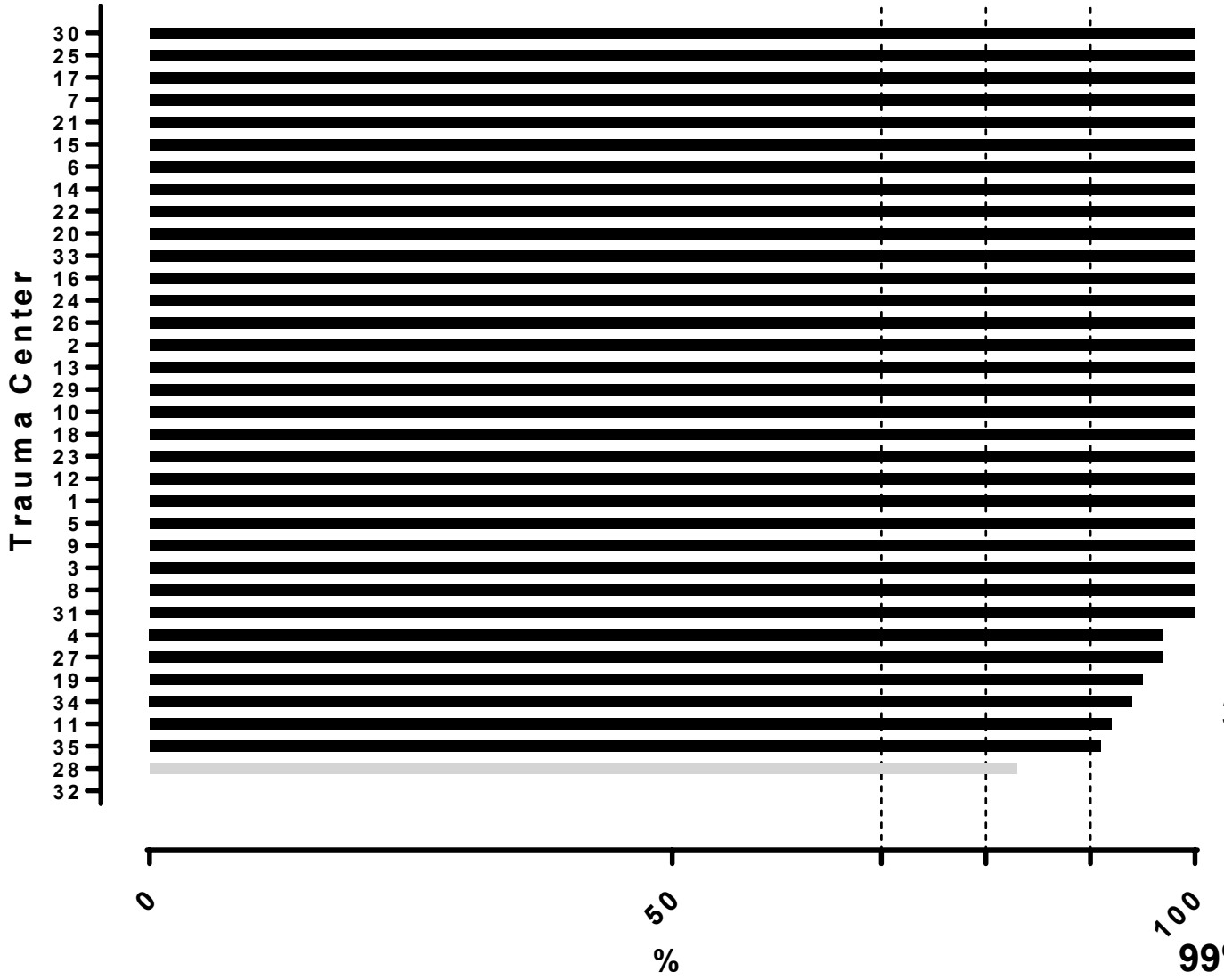
#10 Head CT

- Measure = % of patients with Head CT, date, and time
- Timing
- Treatment
  - 2018 Data collection initiated

Head Injury and Anticoagulation - Head CT Date/Time

Cohort 1 - MTQIP All

7/1/18 - 1/31/19



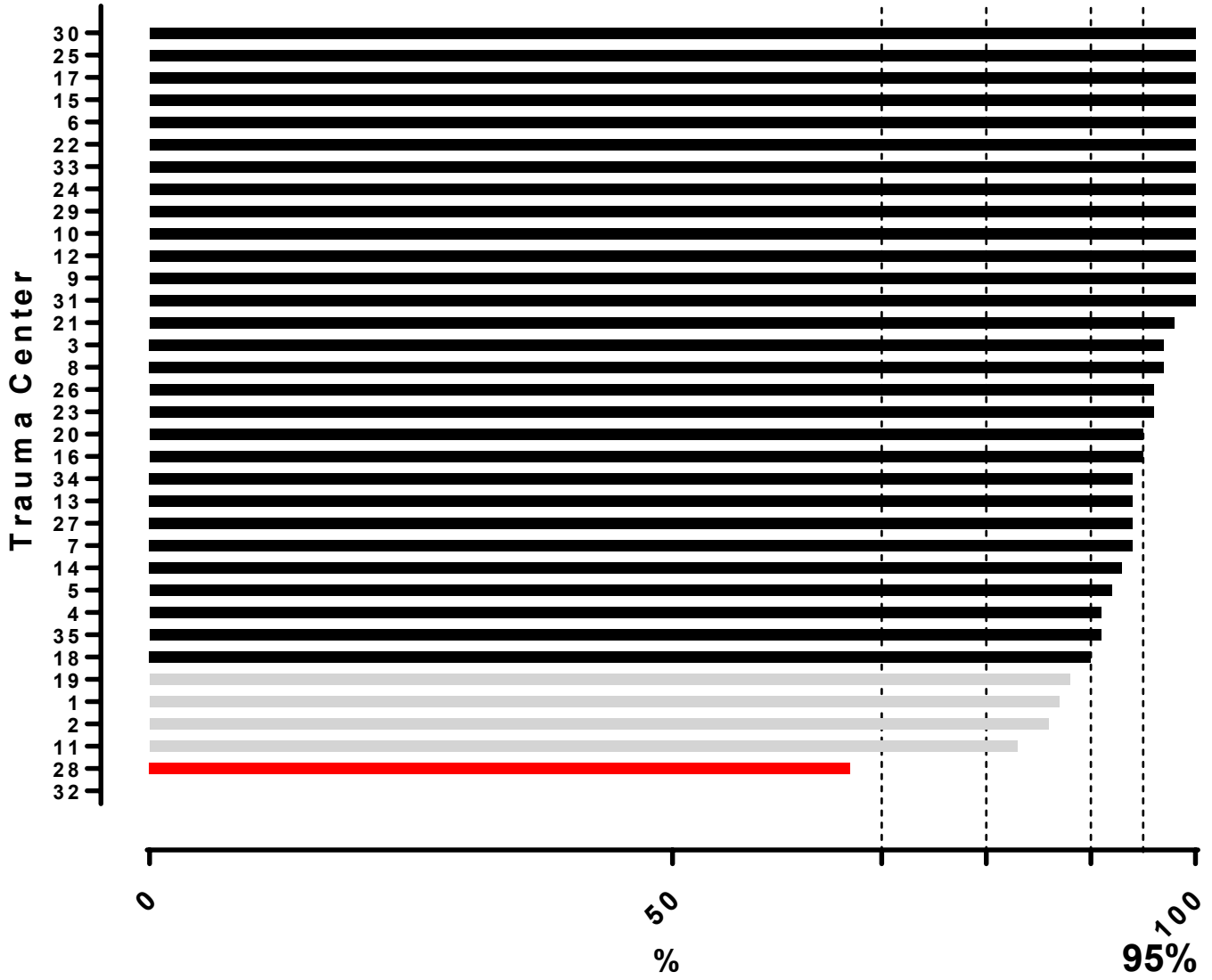
33/35 Centers ≥ 90% (+3)

99%

Head Injury and Anticoagulation - Head CT < 4 hrs

Cohort 1 - MTQIP All

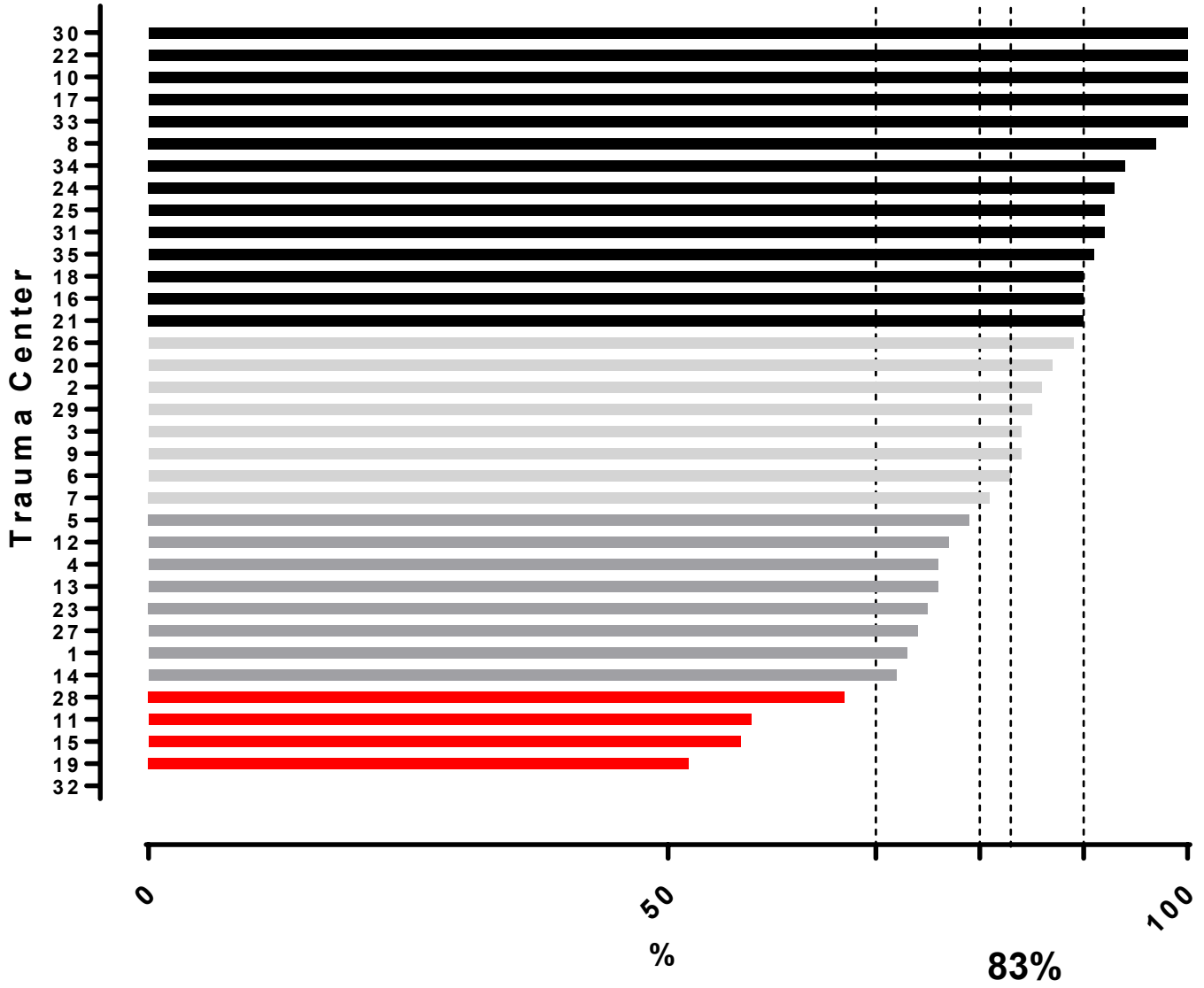
7/1/18 - 1/31/19



Head Injury and Anticoagulation - Head CT < 2 hr

Cohort 1 - MTQIP All

7/1/18 - 1/31/19

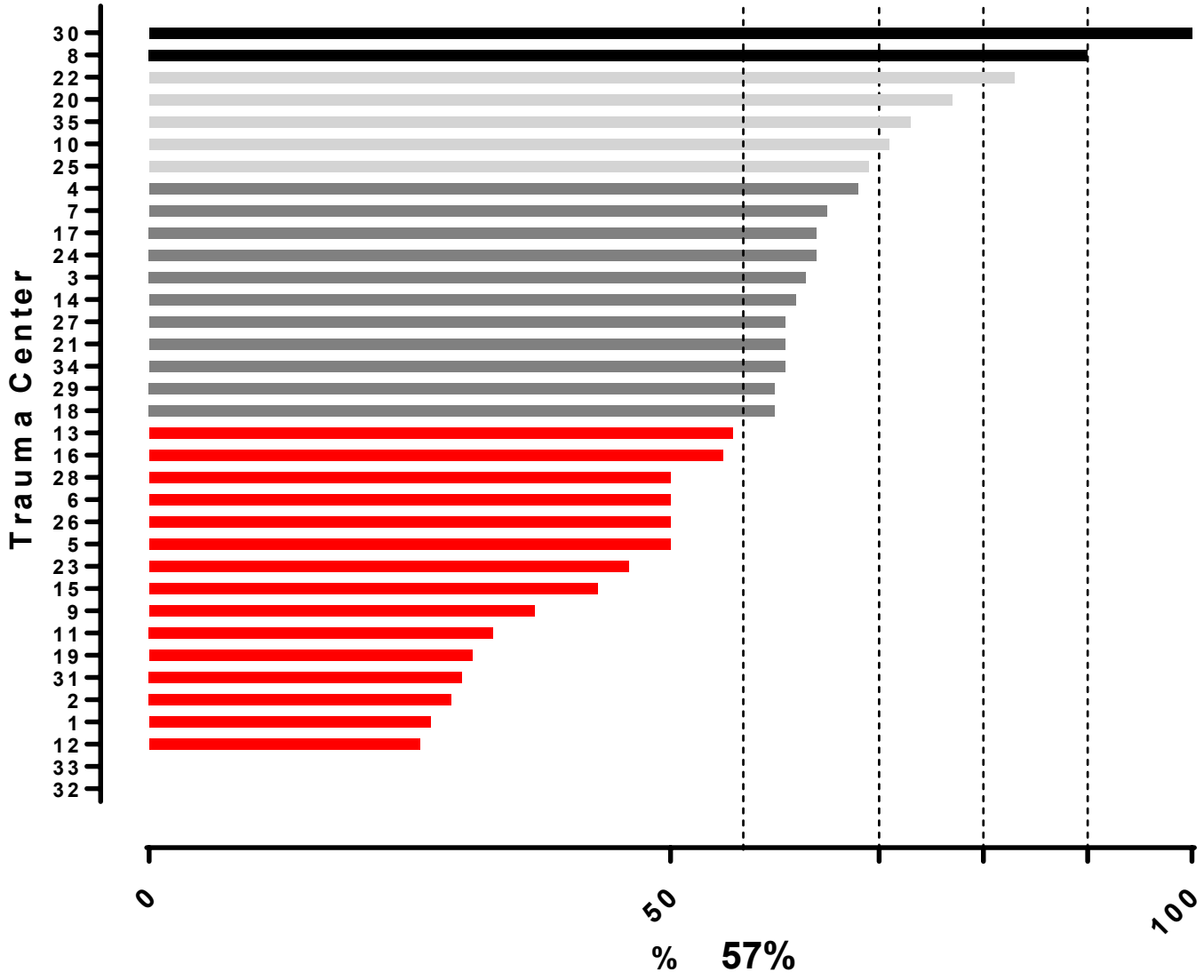


7/1/18-1/31/19

Head Injury and Anticoagulation - Head CT < 1 hr

Cohort 1 - MTQIP All

7/1/18 - 1/31/19



ACS TQIP Collaborative Report

- October 2107 to September 2018
- AIS ≥ 3 in at least one body region of 1-8
- Disposition known
  - Hospital
  - Died in ED
- Age ≥ 16
- Exclude
  - No signs of life
  - Pre-existing advance directive (19% die, 81% alive)
  - Severe burns

VTE

		Patients				
Cohort	Group	N	Pressure Ulcer (%)	Alcohol Withdrawal Syndrome (%)	Deep Vein Thrombosis (%)	Pulmonary Embolism (%)
All Patients	All Others	283,020	0.7	1.0	1.2	0.6
	Collaborative	11,670	0.8	1.6	1.1	0.6

N 1.2 0.6
M 1.1 0.6

		Patients[1]	VTE Prophylaxis				Time to VTE Prophylaxis (days)	Missing Time to VTE Prophylaxis	
Cohort	Group	N	N	%	No Prophylaxis (%)	Status Unknown (%)	Median (IQR)	N	%
All Patients	All Others	272,796	180,843	66.3	33.7	0.0	2 (1-3)	380	0.2
	Collaborative	11,289	8,287	73.6	26.4	0.2	2 (1-2)	8	0.1

National 66.3 33.7
Michigan 73.6 26.4

VTE

National 74.0
Michigan 68.1

		VTE Prophylaxis[1]	Unfractionated Heparin		Low Molecular Weight Heparin		Direct Thrombin or Xa Inhibitor		Coumadin		Other	
Cohort	Group	N	N	%	N	%	N	%	N	%	N	%
All Patients	All Others	180,843	40,677	22.5	133,893	74.0	2,069	1.1	1,303	0.7	2,901	1.6
	Collaborative	8,287	2,126	25.7	5,640	68.1	187	2.3	98	1.2	236	2.8
Blunt Multisystem	All Others	30,773	7,453	24.2	22,849	74.3	135	0.4	63	0.2	273	0.9
	Collaborative	1,005	265	26.4	724	72.0	8	0.8	2	0.2	6	0.6
Penetrating	All Others	10,293	1,595	15.5	8,621	83.8	19	0.2	2	0.0	56	0.5
	Collaborative	306	52	17.0	253	82.7	1	0.3	0	0.0	0	0.0
Shock	All Others	7,788	1,880	24.1	5,732	73.6	53	0.7	20	0.3	103	1.3
	Collaborative	294	84	28.6	195	66.3	4	1.4	6	2.0	5	1.7
Severe TBI	All Others	5,166	2,044	39.6	3,053	59.1	14	0.3	4	0.1	51	1.0
	Collaborative	150	64	42.7	85	56.7	1	0.7	0	0.0	0	0.0
Elderly	All Others	59,814	18,808	31.4	37,329	62.4	1,268	2.1	1,053	1.8	1,356	2.3
	Collaborative	3,471	1,104	31.8	2,045	58.9	135	3.9	81	2.3	106	3.1
Elderly Blunt Multisystem	All Others	6,959	2,337	33.6	4,426	63.6	72	1.0	40	0.6	84	1.2
	Collaborative	277	91	32.9	176	63.5	7	2.5	2	0.7	1	0.4
Isolated Hip Fracture	All Others	29,181	5,459	18.7	19,739	67.6	1,488	5.1	826	2.8	1,669	5.7
	Collaborative	3,195	794	24.9	1,891	59.2	152	4.8	97	3.0	261	8.2

[1] Excluding deaths in the ED, deaths within the first 48 hours of arrival, and deaths with unknown time to death

Table 15: First Operative Internal or External Fixation in Elderly Patients with Isolated Hip Fracture

	Isolated Hip Fracture	Operative Fixation		Time to Operative Fixation (hours)	Operative Fixation more than 48 Hours		Missing Time to Operative Fixation	
Group	N	N	%	Median (IQR)	N	%	N	%
All Others	34,801	30,807	88.5	21.98 (15.95-30.83)	2,890	9.4	172	0.6
Collaborative	3,431	3,157	92.0	22.37 (16.92-30.72)	267	8.5	2	0.1

National 9.4
Michigan 8.5

Table 16: First Operative Internal or External Fixation in Patients with Mid-Shaft Femur Fracture

	Mid-Shaft Femur Fracture	Operative Fixation		Time to Operative Fixation (hours)	Operative Fixation more than 24 Hours		Missing Time to Operative Fixation	
Group	N	N	%	Median (IQR)	N	%	N	%
All Others	17,310	15,586	90.0	15.53 (7.07-23.78)	3,799	24.6	117	0.8
Collaborative	843	725	86.0	17.58 (9.04-25.71)	209	28.9	1	0.1

National 25
Michigan 29

Table 17: First Operative Internal or External Fixation in Patients with Open Tibia Shaft Fracture

	Open Tibia Shaft Fracture	Operative Fixation		Time to Operative Fixation (hours)	Operative Fixation more than 24 Hours		Missing Time to Operative Fixation	
Group	N	N	%	Median (IQR)	N	%	N	%
All Others	5,605	5,170	92.2	6.33 (3.03-14.3)	466	9.1	35	0.7
Collaborative	184	169	91.8	5.88 (3.29-14.32)	18	10.7	1	0.6

National 9.1
Michigan 10.7

Table 18: Operative Irrigation and Debridement in Patients with Open Tibia Shaft Fracture

	Open Tibia Shaft Fracture	Irrigation and Debridement		Time to First Irrigation and Debridement (hours)	Irrigation and Debridement within 24 Hours		Missing Time to Irrigation and Debridement	
Group	N	N	%	Median (IQR)	N	%	N	%
All Others	5,605	5,284	94.3	7.38 (3.5-15.27)	4,655	88.7	36	0.7
Collaborative	184	171	92.9	6.52 (3.33-15.3)	149	87.6	1	0.6

National 88.7
Michigan 87.6

Hemorrhagic Shock

Table 28: Hemorrhagic Shock Management

	Patients	Surgery for Hemorrhage Control		Angiography		Neither Surgery for Hemorrhage Control or Angiography	
Group	N	N	%	N	%	N	%
All Others	7,055	3,810	54.2	1,245	17.8	2,602	37.1
Collaborative	196	92	46.9	20	10.2	90	45.9
Note: Patients may have both surgery for hemorrhage control and angiography							

National 37.1
Michigan 45.9

Table 29: Angiography for Hemorrhagic Shock Patients

	Patients	Angiography		Time to Angiography (hours)	Missing Time to Angiography	
Group	N	N	%	Median (IQR)	N	%
All Others	7,055	1,245	17.8	2.9 (1.48-4.7)	36	2.9
Collaborative	196	20	10.2	2.97 (1.65-5.37)	1	5.0

National 2.9
Michigan 2.97

Hemorrhagic Shock

Table 30: Embolization for Hemorrhagic Shock Patients

					Embolization Site													
	Patients	Angiography	Angiography with Embolization		Liver		Spleen		Kidney		Pelvis/ Retroperitoneum		Peripheral Vascular		Aorta		Other	
Group	N	N	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
All Others	7,055	1,245	719	57.8	102	14.2	144	20.0	22	3.1	354	49.2	61	8.5	28	3.9	67	9.3
Collaborative	196	20	11	55.0	2	18.2	1	9.1	2	18.2	6	54.5	0	0.0	0	0.0	0	0.0
Note: Multiple methods are possible for an individual patient																		

N 57.8
M 55.0

Table 31: Surgery for Hemorrhage Control for Hemorrhagic Shock Patients

	Patients	Surgery for Hemorrhage Control		Time to Surgery for Hemorrhage Control (hours)	Missing Time to Surgery for Hemorrhage Control	
Group	N	N	%	Median (IQR)	N	%
All Others	7,055	3,810	54.2	0.97 (0.58-2)	111	2.9
Collaborative	196	92	46.9	1.4 (0.72-2.37)	1	1.1

National 0.97
Michigan 1.4

Hemorrhagic Shock

Table 34: Massive Transfusion Protocol: Plasma to Packed Red Blood Cells (PRBC) Ratios for Hemorrhagic Shock Patients

	Patients[1]	Plasma:PRBC Transfused Ratio between 1:1 and 1:2	
Group	N	N	%[2]
All Others	2,196	1,476	67.2
Collaborative	53	44	83.0

[1] Patients receiving more than 6 units of PRBCs within 4 hours from ED/Hospital arrival
[2] Patients with no plasma or unknown volume of plasma are included in the denominator

National 67.2
Michigan 83.0

Break

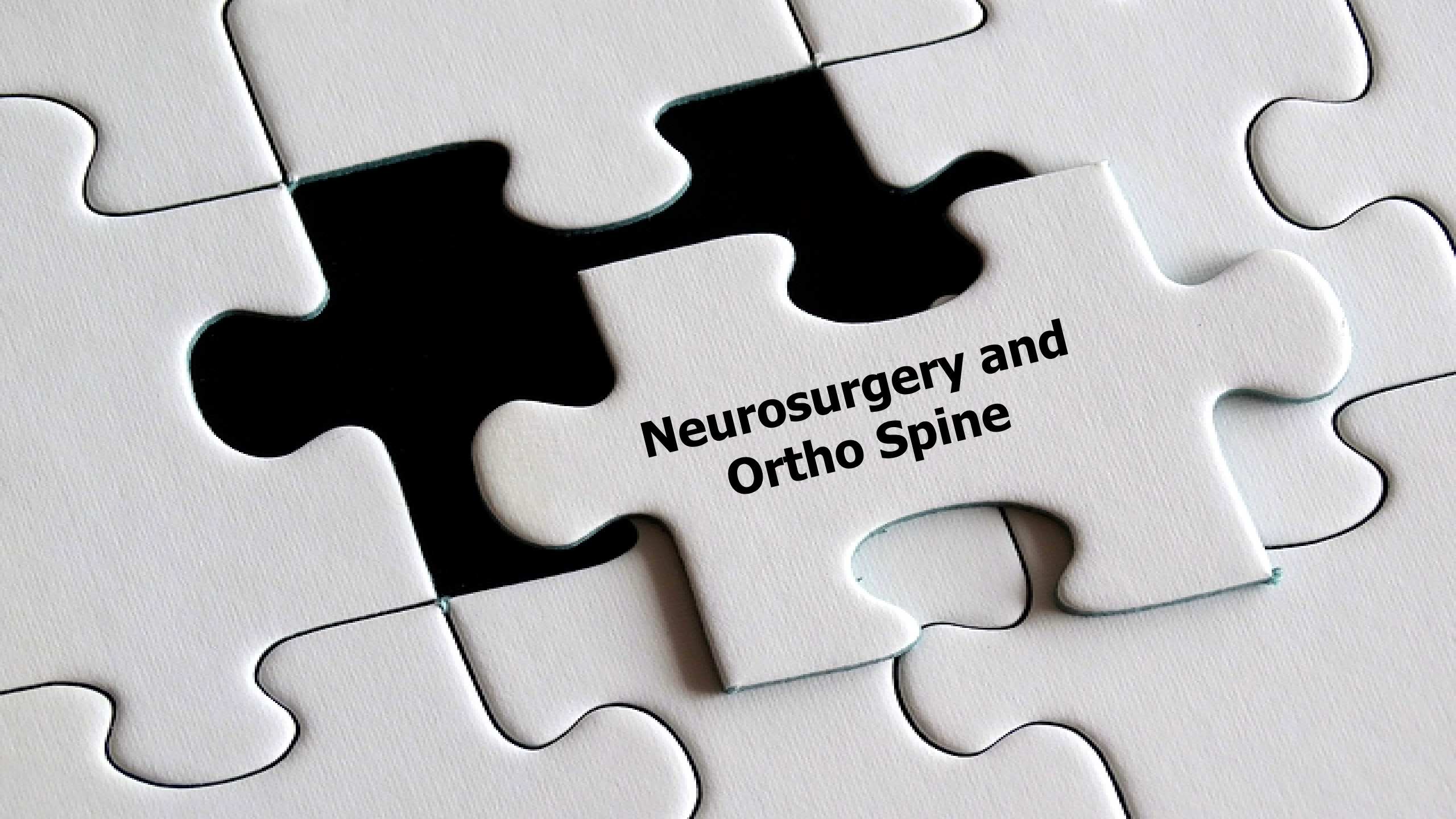
Back at 3:15 pm

TBI/Spine Fracture Data

Jill Jakubus, PA-C

Mark and Jill,

Do you have data on what percentage of patients with TBI or spine fractures receive LMWH within 48 hrs in the MTQIP database? I'd love to be able to present that data to my neurosurgeons.


Neurosurgery and
Ortho Spine

TBI Code

```
replace tbi_case=1 if aiscode>100000.0 & aiscode<200000
replace tbi_case=0 if aiscode==100099.1 /*fake code*/
replace tbi_case=0 if aiscode==100099.2 /*fake code*/
replace tbi_case=0 if aiscode==100099.3 /*fake code*/
replace tbi_case=0 if aiscode==100099.4 /*fake code*/
replace tbi_case=0 if aiscode==100099.5 /*fake code*/
replace tbi_case=0 if aiscode==100099.9 /*Injuries to the Head NFS*/
replace tbi_case=0 if aiscode==115099.9 /*Injuries to the Head NFS, AIS 98*/
replace tbi_case=0 if aiscode==100999.9 /*Injuries to the Head NFS - died of head injury without further substantiation of injuries*/
replace tbi_case=0 if aiscode==115999.9 /*Injuries to the Head NFS - died of head injury without further substantiation of injuries, AIS 98*/
replace tbi_case=0 if aiscode==110009.1 /*Head Injury NFS involving only headache*/
replace tbi_case=0 if aiscode==160402.1 /*Head Injury NFS involving only headache, AIS 98*/
replace tbi_case=0 if ais
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replace tbi_case=0 if ais
replace tbi_case=0 if ais
replace tbi_case=0 if aiscode==122802.5 /*Vertebral artery NFS laceration*/
replace tbi_case=0 if aiscode==122803.6 /*Vertebral artery - laceration - bilateral*/
replace tbi_case=0 if aiscode==122804.3 /*Vertebral artery NFS thrombosis; occlusion*/
replace tbi_case=0 if aiscode==122805.4 /*Vertebral artery NFS thrombosis; bilateral*/
replace tbi_case=0 if aiscode==122806.3 /*Vertebral artery NFS traumatic aneurysm*/
replace tbi_case=0 if (aiscode>=130202 & aiscode<=132699) /*Nerves cranial section*/
replace tbi_case=0 if aiscode==140212.6 /*Brain stem - laceration*/
replace tbi_case=0 if aiscode==140214.6 /*Brain stem massive destruction (crush -type injury)*/
replace tbi_case=0 if aiscode==140216.6 /*Brain stem penetrating injury*/
replace tbi_case=0 if aiscode==140218.6 /*Brain stem transection*/
replace tbi_case=0 if aiscode==140489.9 /*Cerebellum - trauma-associated findings not related either to intervention or to anatomically-described head injury NFS*/
replace tbi_case=0 if aiscode==140684.3 /*Cerebrum - subarachnoid hemorrhage with or without coma >6 hrs, AIS 98*/
replace tbi_case=0 if aiscode==140686.3 /*Cerebrum - subpial hemorrhage with or without coma >6 hrs, AIS 98*/
replace tbi_case=0 if aiscode==140688.4 /*Cerebrum - laceration with or without >2 cm depth, AIS 98*/
replace tbi_case=0 if aiscode==140689.9 /*Cerebrum - trauma-associated findings not related either to intervention or to anatomically-described head injury NFS*/
replace tbi_case=0 if aiscode==140701.9 /*Cerebrum - hypoxic or ischemic brain damage secondary to systemic hypoxemia, hypotension or shock not directly related to head trauma*/
replace tbi_case=0 if aiscode==140702.9 /*Cerebrum - hypoxic or ischemic brain damage secondary to systemic hypoxemia, hypotension or shock not directly related to head trauma
replace tbi_case=0 if aiscode==140703.9 /*Cerebrum - hypoxic or ischemic brain damage secondary to systemic hypoxemia, hypotension or shock not directly related to head trauma
replace tbi_case=0 if (aiscode>=150000 & aiscode<=150408.4) /*Skeletal skull fracture section*/
replace tbi_case=0 if (aiscode>=161000 & aiscode<=161005.2) /*Concussion/DAI section*/
```
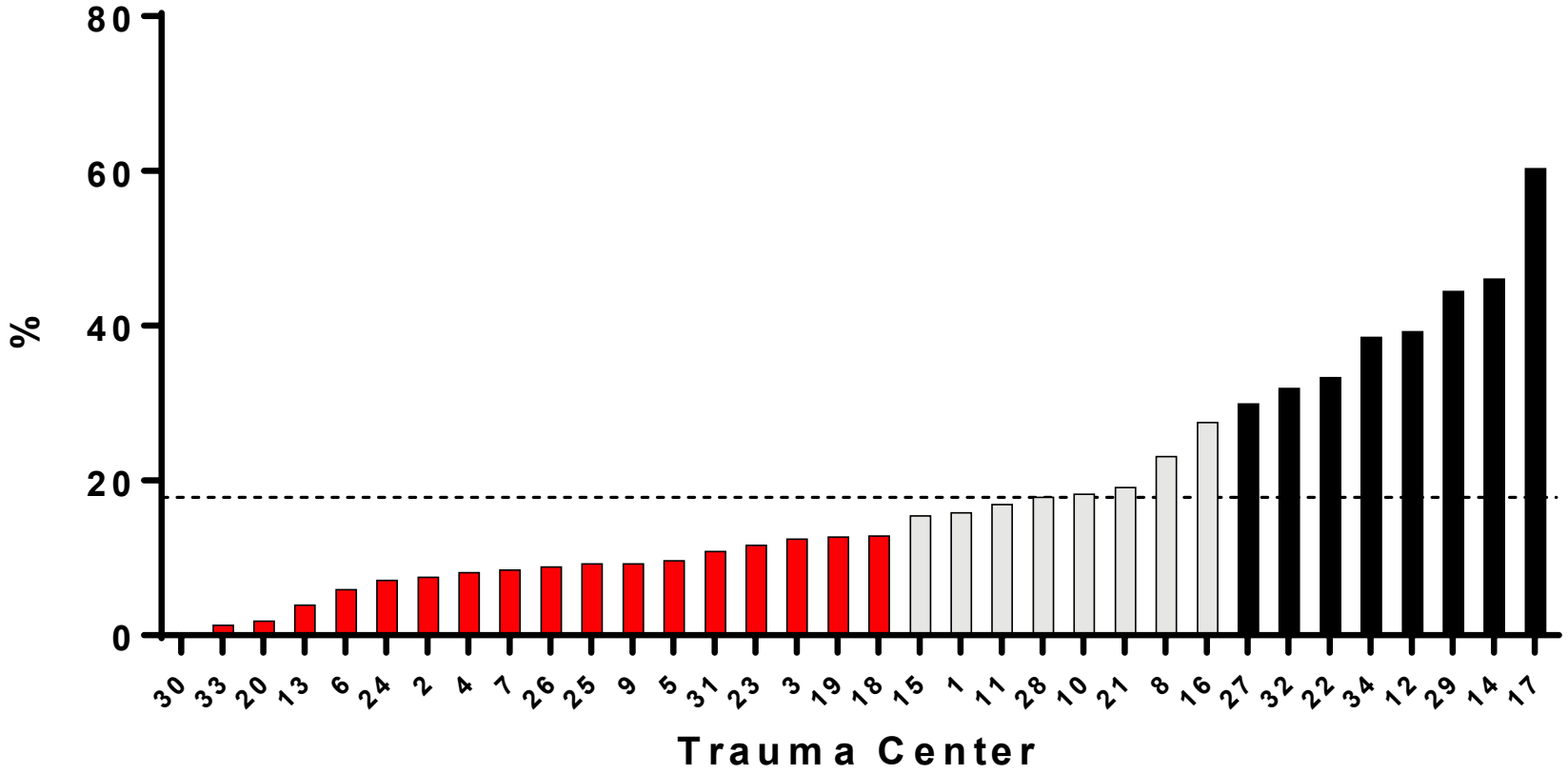
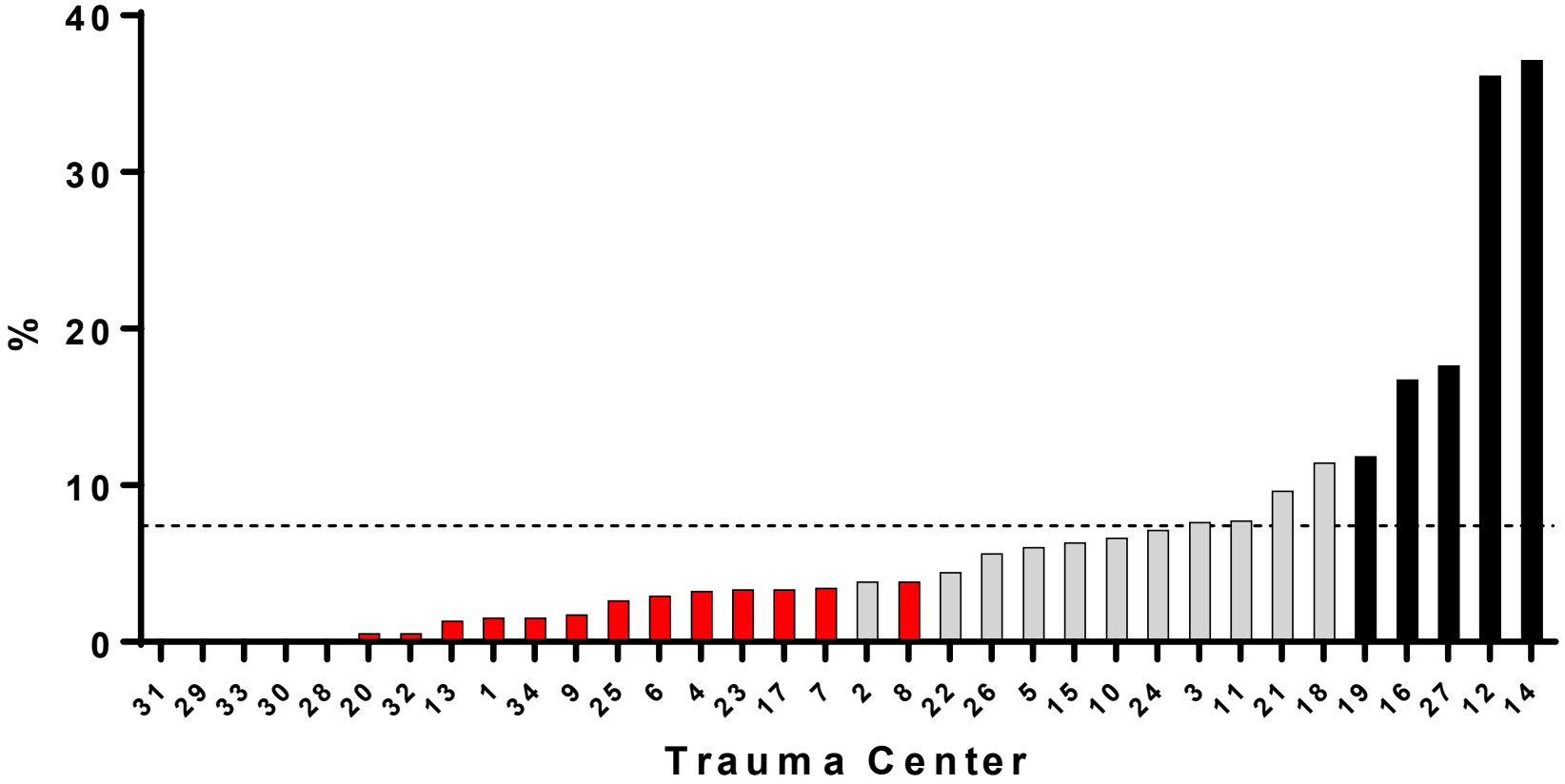

- Keep AIS head injury codes
- Exclude non-head injury codes
- Exclude DOA
- Keep age >= 16
- Exclude transfers out
- Date range: 1/1/17 – 12/31/17

VTE Prophylaxis Timing <= 48 Hours
Cohort - TBI
1/1/17 - 12/31/17



VTE Prophylaxis Timing <= 48 Hours, LMWH
Cohort - TBI
1/1/17 - 12/31/17



Spine Code

```
replace spine_case=1 if aiscode==600099.9 /*Cervical Spine - Injuries to the Cervical Spine NFS*/
*replace spine_case=1 if aiscode==600999.9 /*Cervical Spine - Injuries to the Cervical Spine NFS Died of thoracic spine injury without further substantiation of
replace spine_case=1 if aiscode==620099.9 /*Thoracic Spine - Injuries to the Thoracic Spine NFS*/
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replace spine_case=1 if aiscode==650204.2 /*Cervical Spine - Dislocation [subluxation], no fracture, no cord involvement NFS*/
replace spine_case=1 if aiscode==650206.3 /*Cervical Spine - Dislocation [subluxation], no fracture, no cord involvement NFS atlanto -axial (odontoid)*/
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replace spine_case=1 if aiscode==650430.2 /*Thoracic Spine - Fracture with or without dislocation but no cord involvement NFS vertebral body NFS*/
replace spine_case=1 if aiscode==650432.2 /*Thoracic Spine - Fracture with or without dislocation but no cord involvement NFS vertebral body NFS minor compressio
replace spine_case=1 if aiscode==650434.3 /*Thoracic Spine - Fracture with or without dislocation but no cord involvement NFS vertebral body NFS major compressio
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```
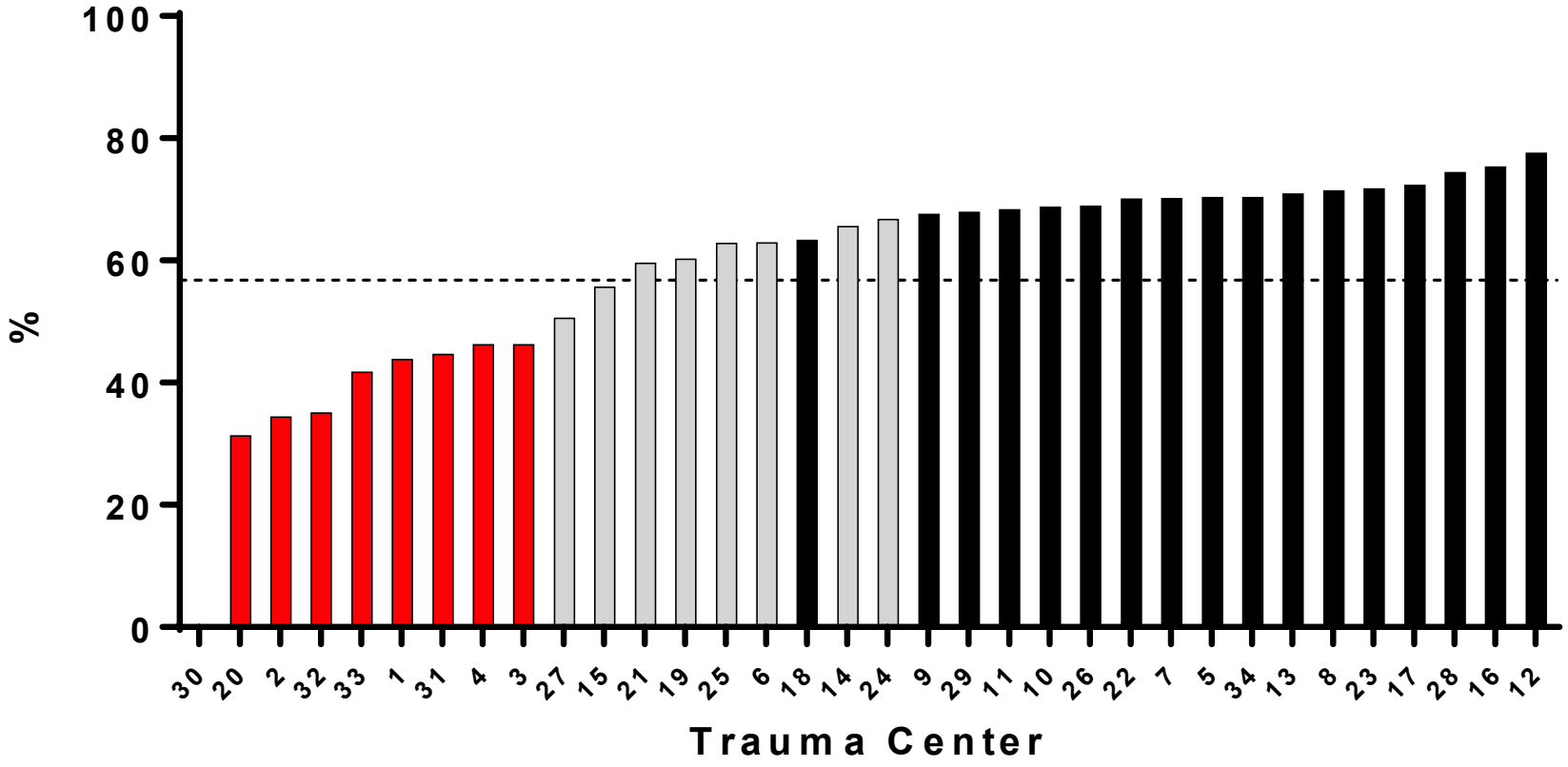
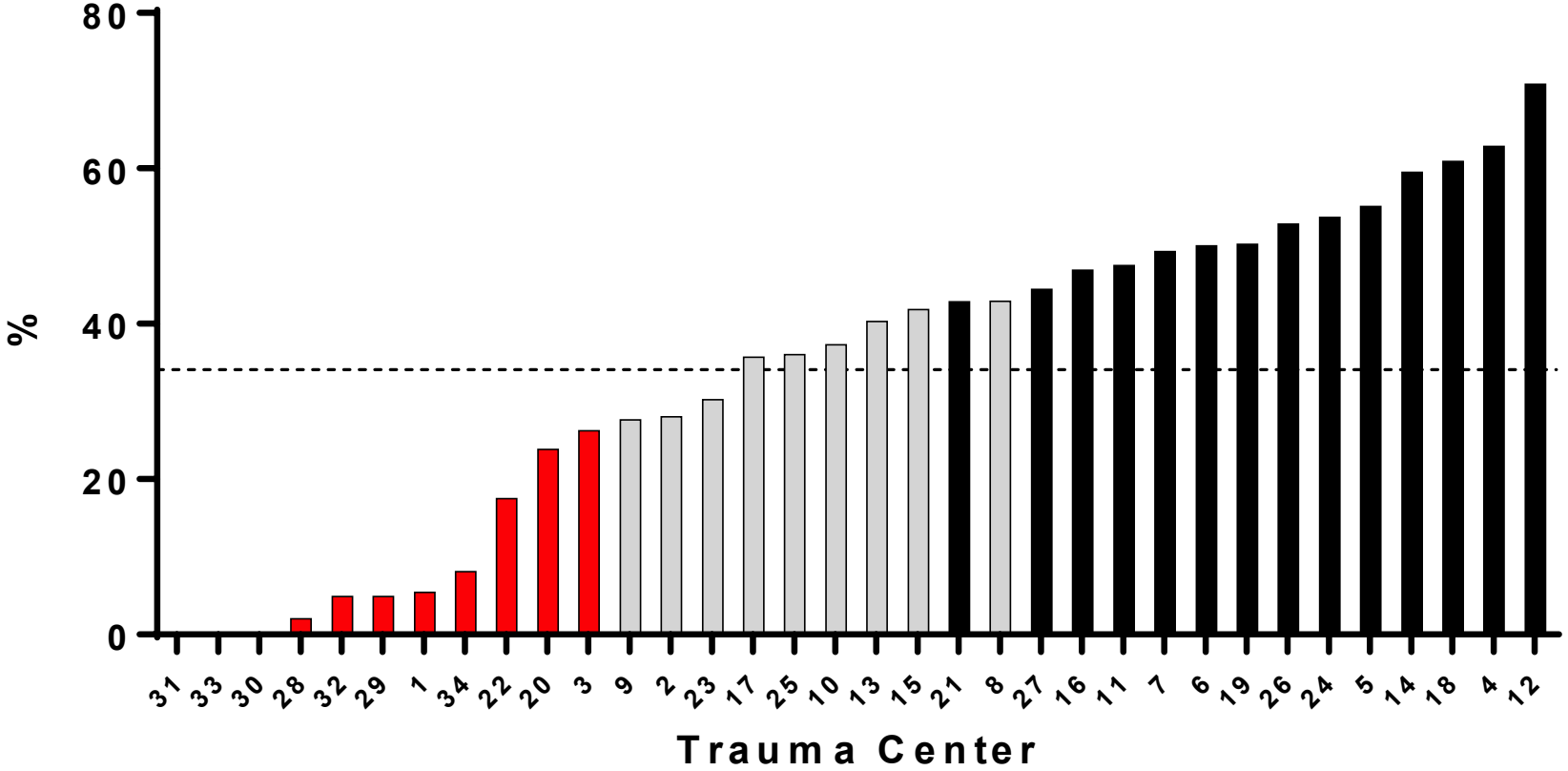

- **Keep AIS spine fracture or subluxation**
- **Exclude DOA**
- **Keep age >= 16**
- **Exclude transfers out**
- **Date range 1/1/17 – 12/31/17**

VTE Prophylaxis Timing <= 48 Hours
Cohort - Spine Injury
1/1/17 - 12/31/17



VTE Prophylaxis Timing <= 48 Hours, LMWH
Cohort - Spine Injury
1/1/17 - 12/31/17



Improving VTE Prophylaxis Rates – Slowly, Slowly

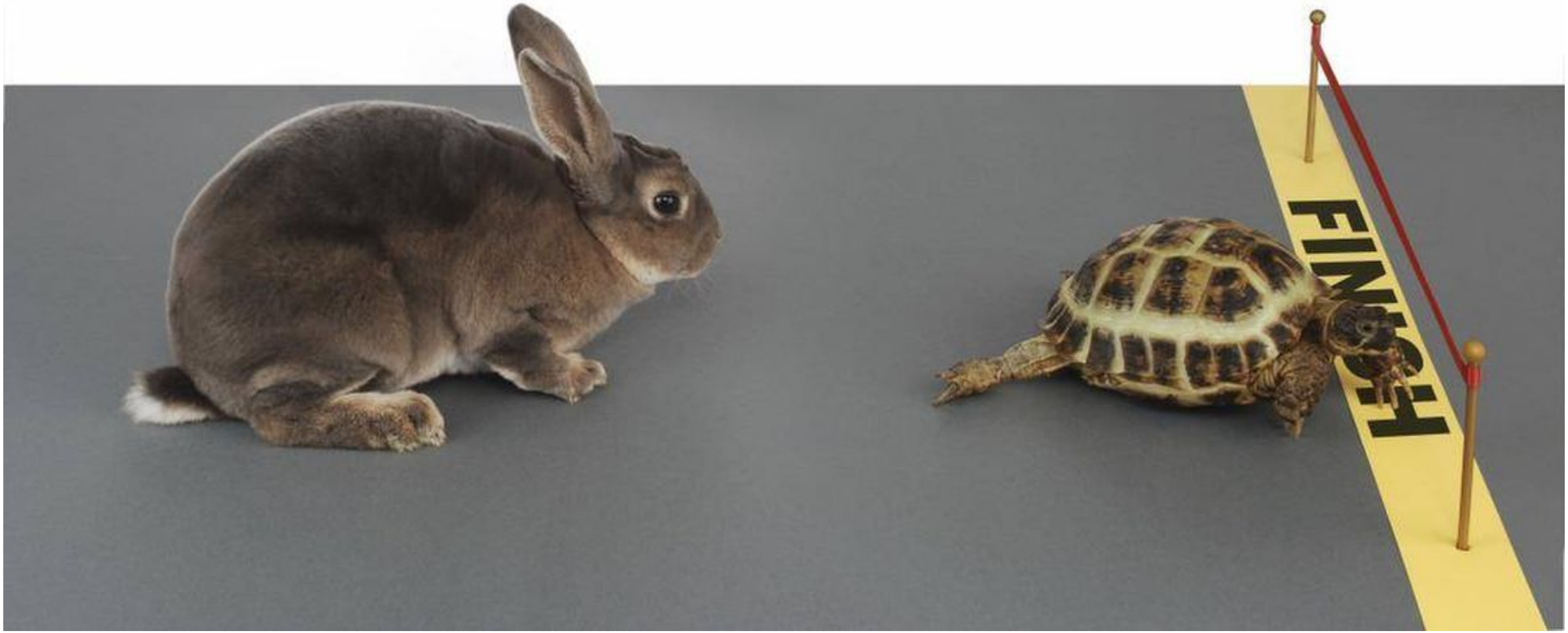
MTQIP meeting

May 8, 2019

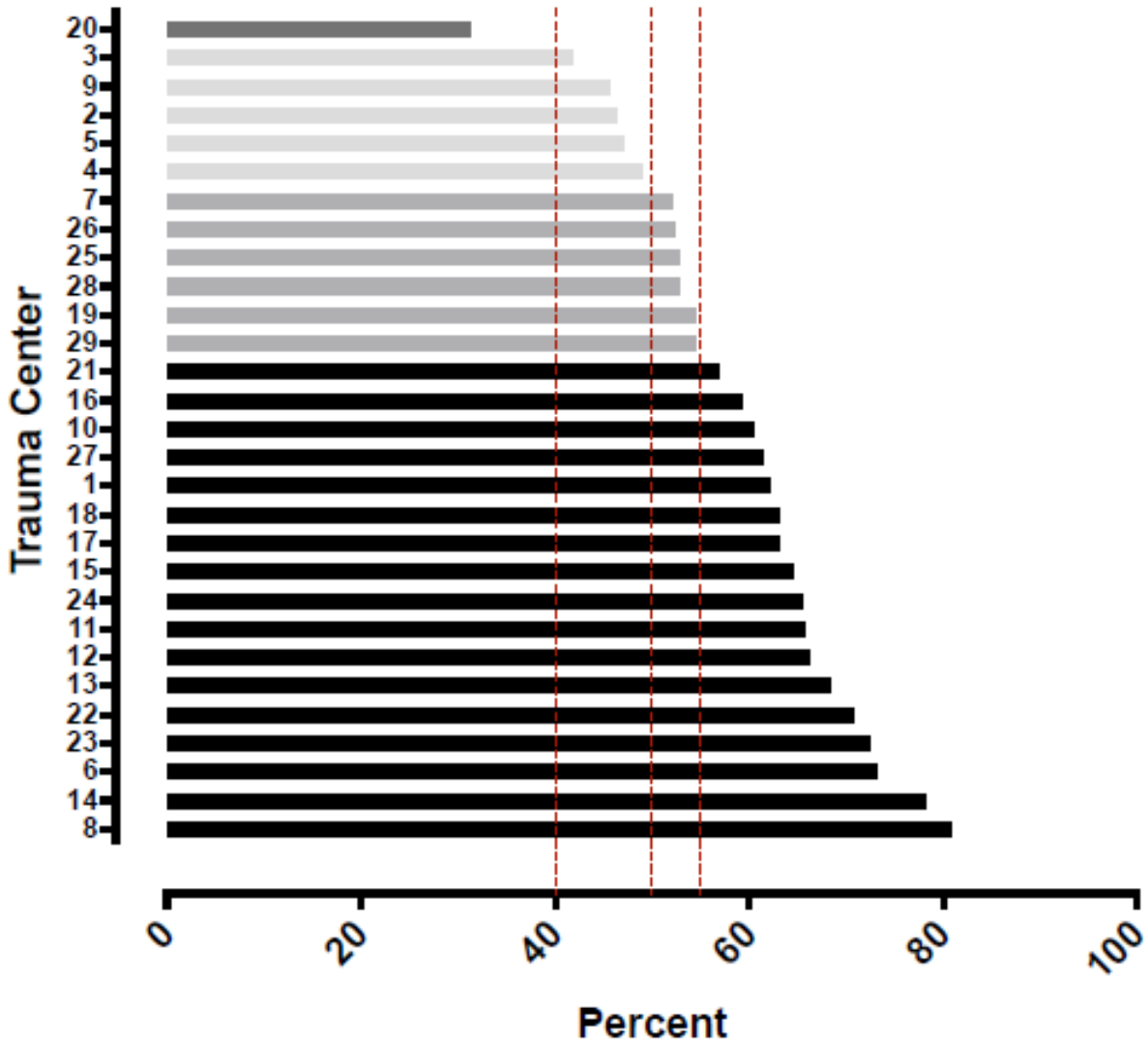
Kristen Sihler, MD, MS, FACS

Munson Medical Center, Traverse City

It does not matter how slowly you go as long as you do not stop. - Confucius


FINISH

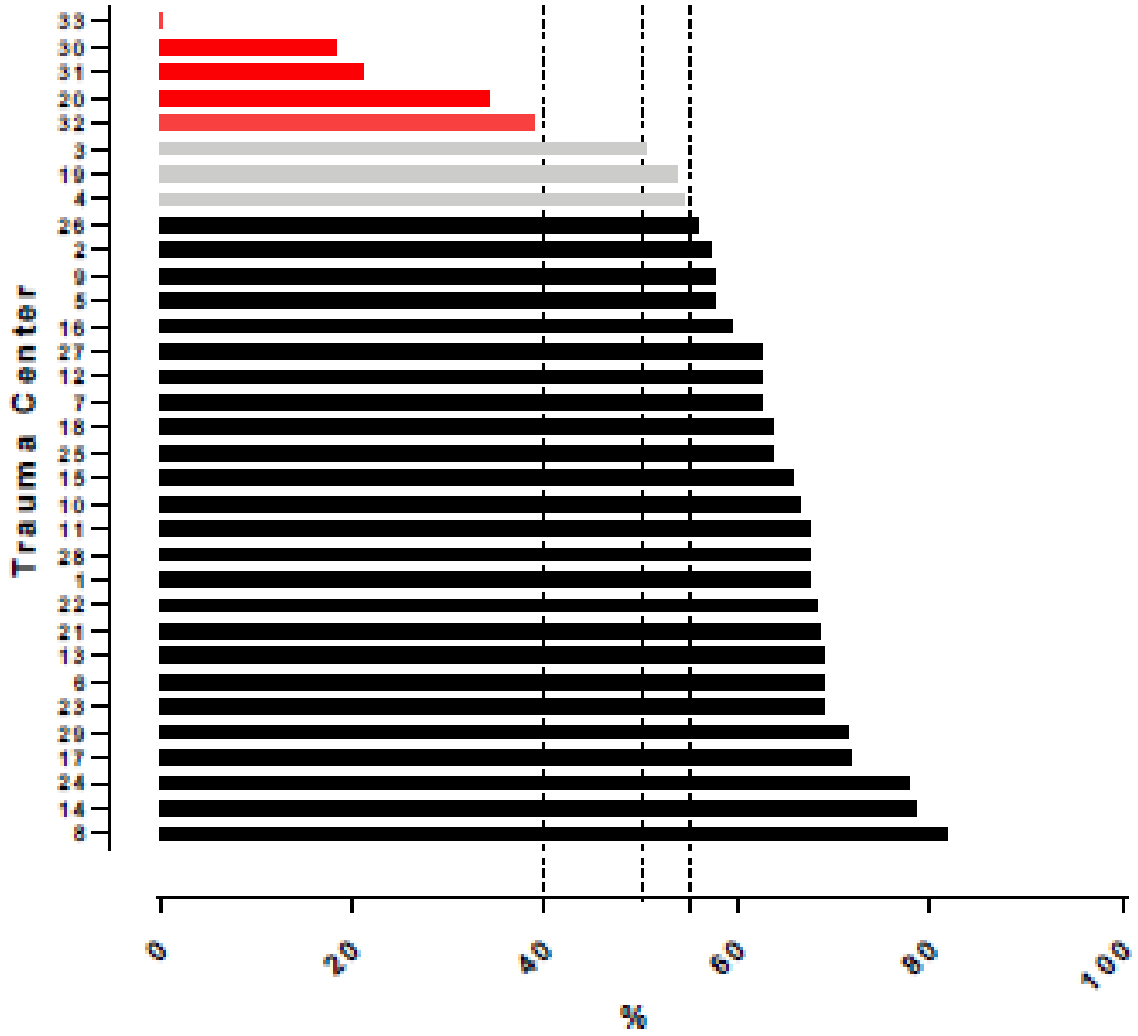
VTE Prophylaxis Timing ≤ 48 hrs
1/1/17 - 9/30/17



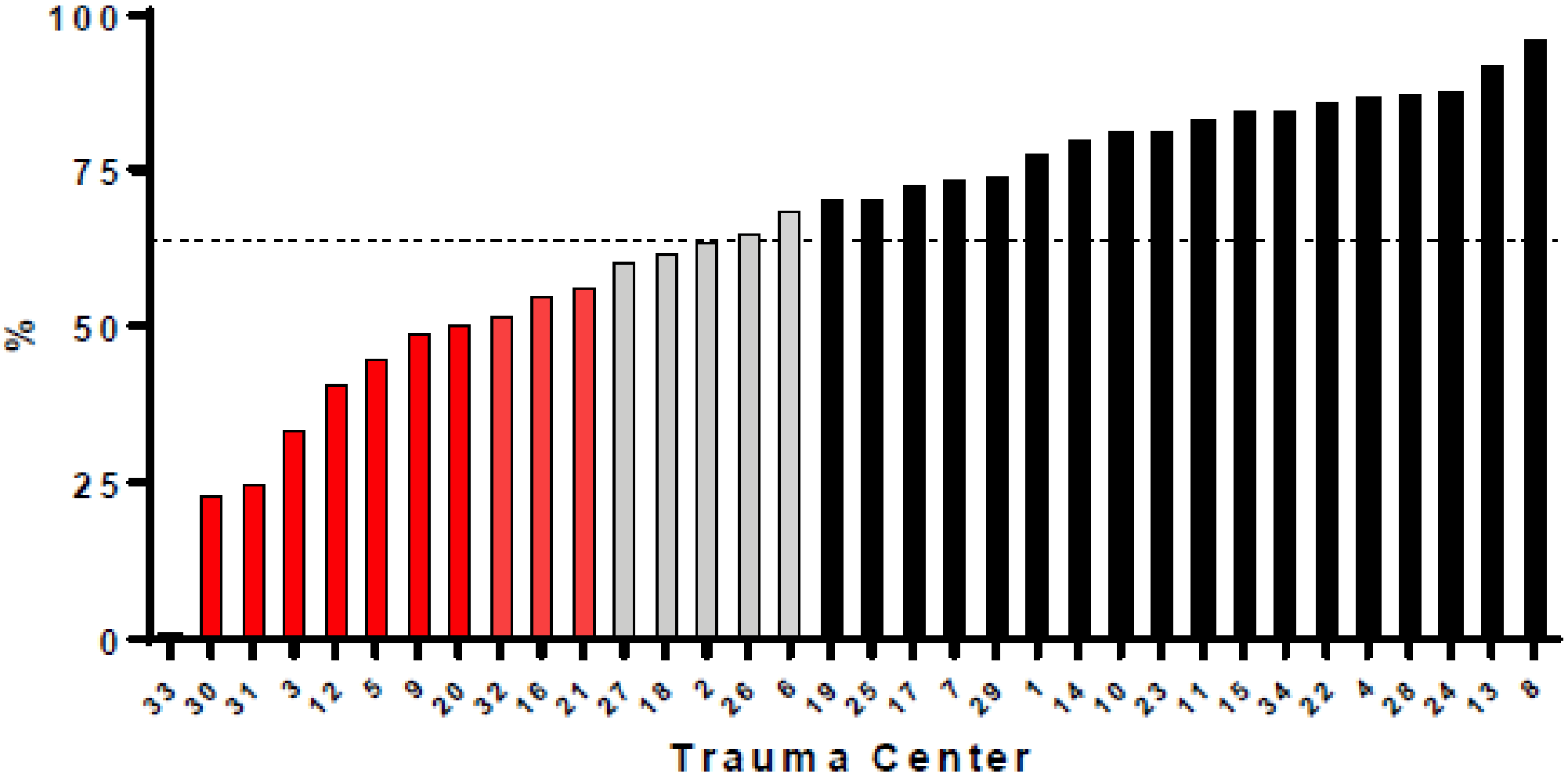
VTE Prophylaxis Timing <= 48 hrs

Cohort 2 - Admit to Trauma

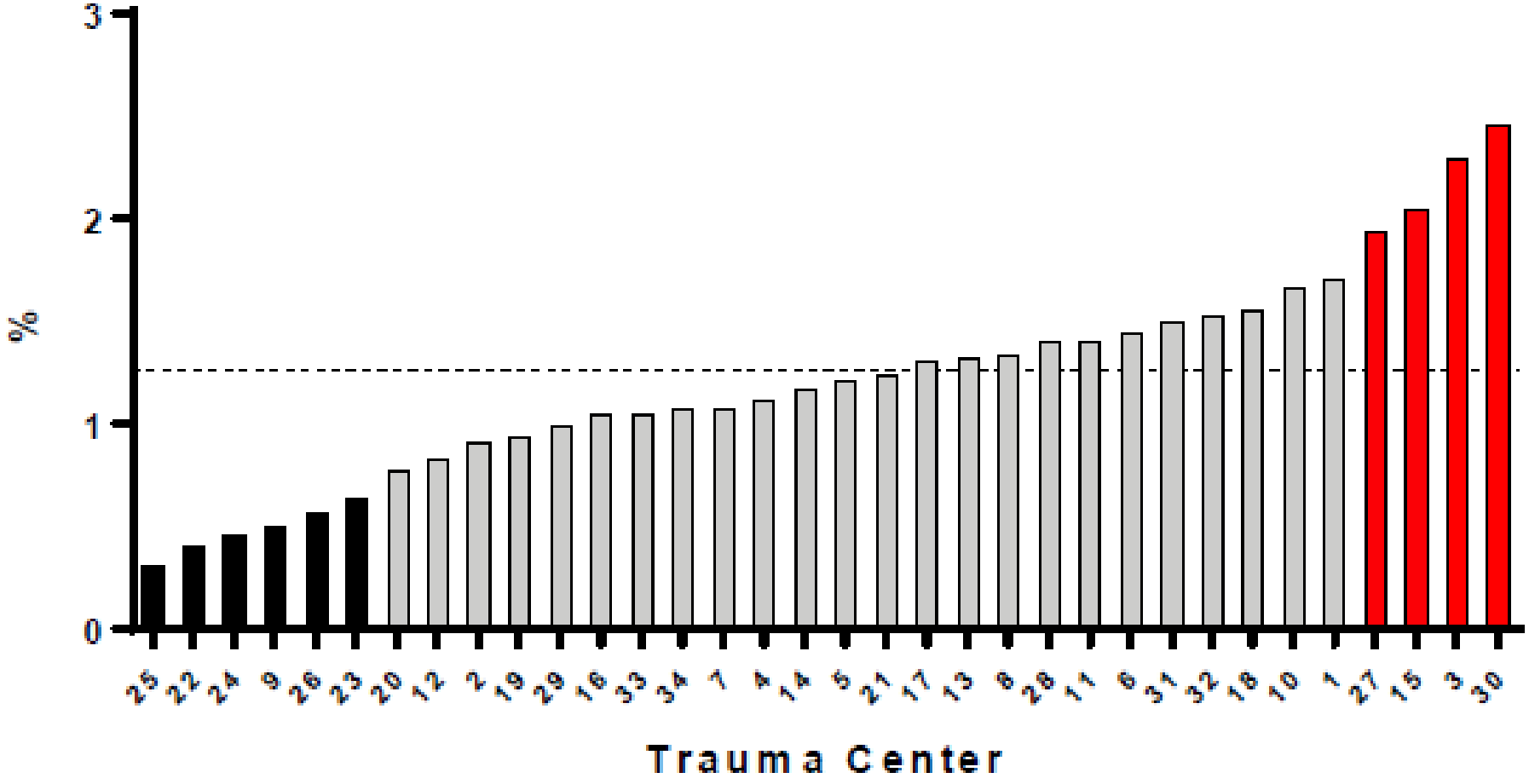
1/1/17 - 6/30/18



VTE Prophylaxis Heparin, LMWH <= 48 hrs
Cohort 8 - Isolated Hip Fracture



DVT/Pulmonary Embolus
Cohort 2 - Admit to Trauma



Progress . . .

- VTE Timing 2017

VTE Prophylaxis Timing - <= 48 Hrs
Cohort 2 (Admit to Trauma Service), Exclude DOAs, Exclude Transfers Out, 2017

- VTE Timing partial year 2018 Through July

VTE Prophylaxis Timing - <= 48 Hrs
Cohort 2 (Admit to Trauma Service), Exclude DOAs, Exclude Transfers Out, 2018

Barriers

VTE Prophylaxis Outcomes at 48 Hrs - Heparin, LMWH <= 48 Hrs
Exclude DOAs, AIS Head/Neck >= 3, Exclude Transfers Out, 2017

VTE Prophylaxis Outcomes at 48 Hrs - Heparin, LMWH <= 48 Hrs
AIS Head/Neck >= 3, 2018

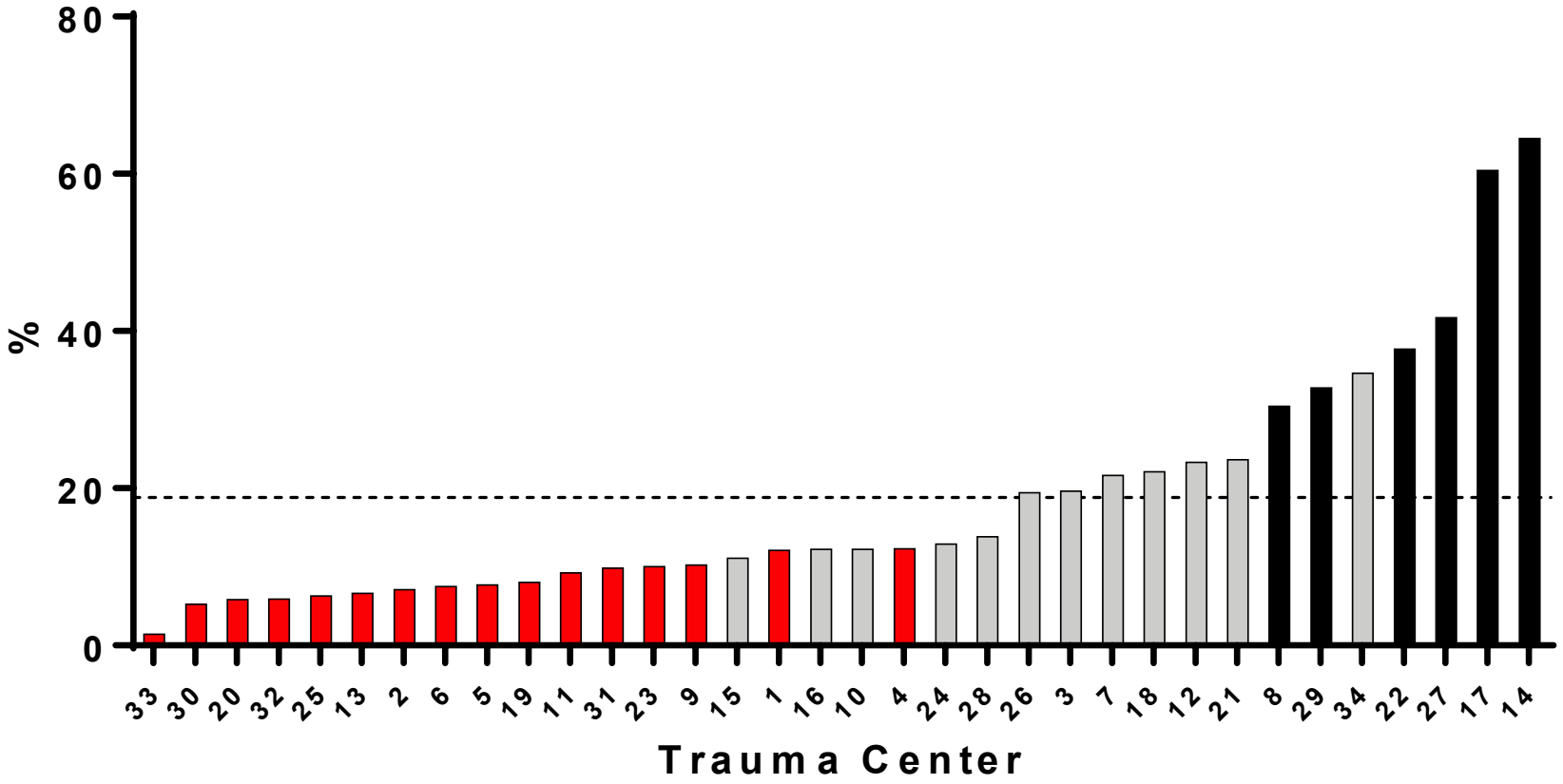
Table 23: Pharmacologic VTE Prophylaxis by Cohort

Strategies – changing culture slowly

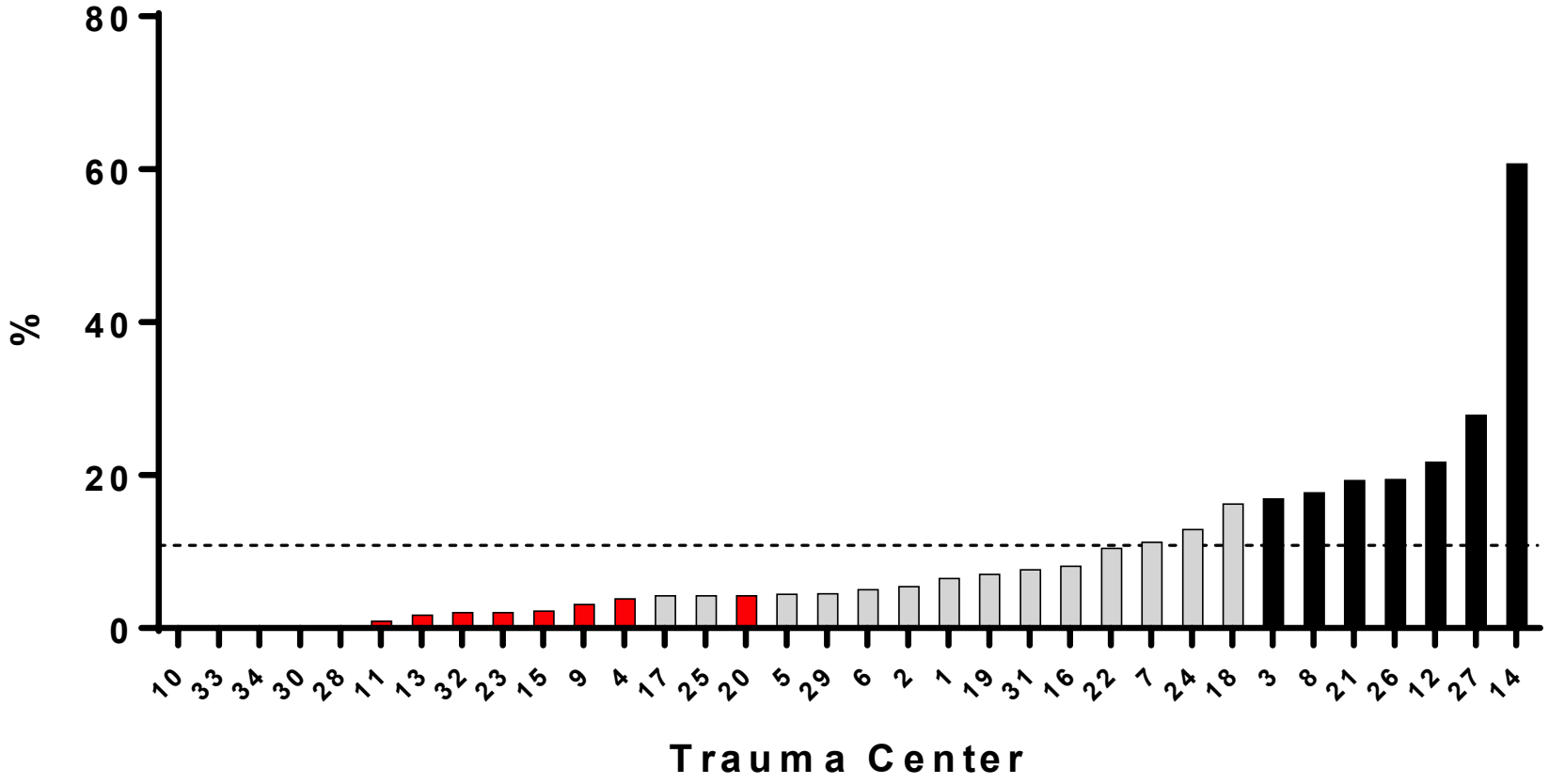
- TMD/TPM/MCRs at morning signout M-F
- Cases and data to PI meetings
- TMD meeting with neurosurgery
- Surgical administration meeting with neurosurgery
- Meetings with ortho and internal medicine (hip fractures)
- Nursing education

Bonus Update

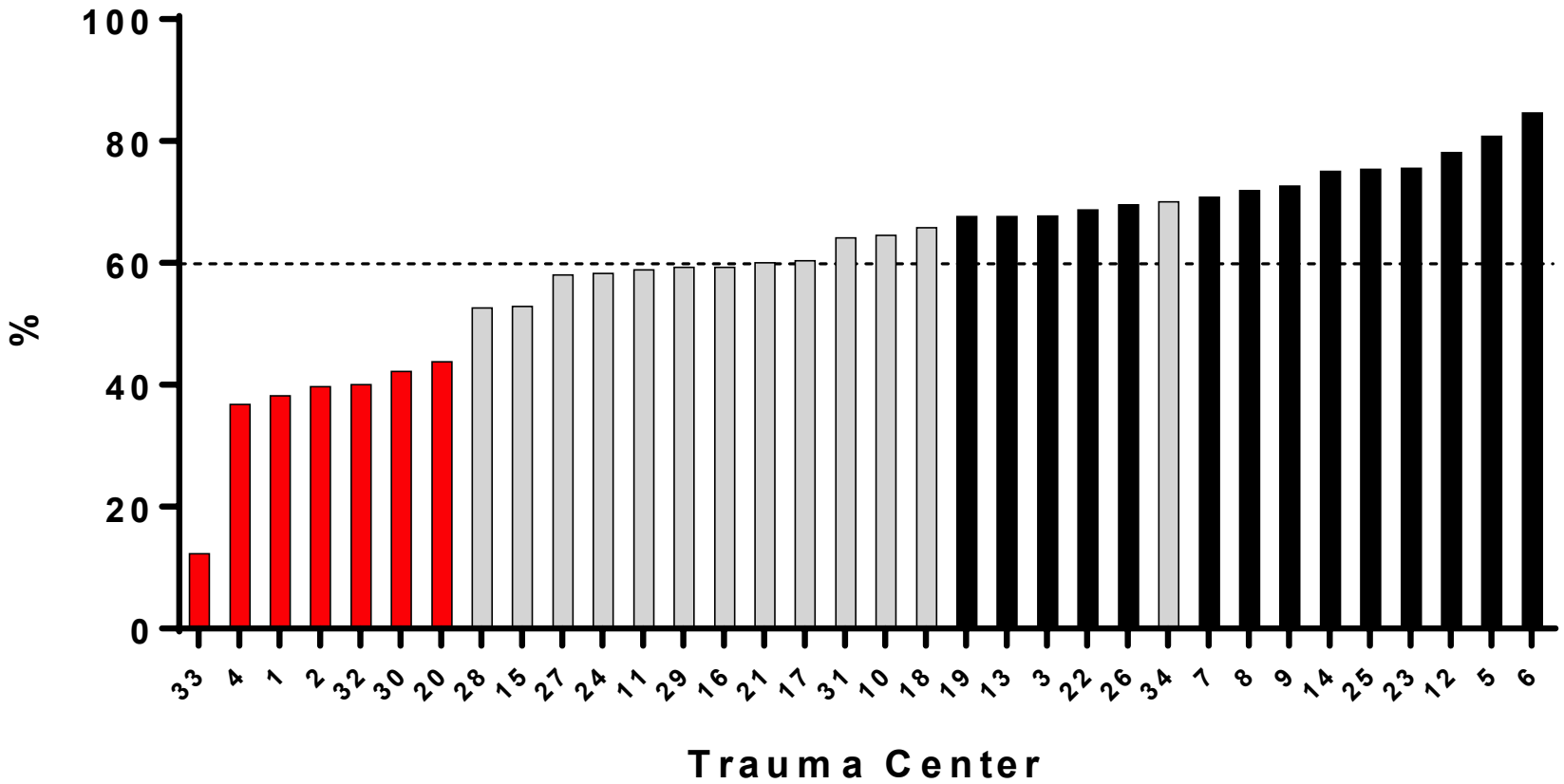
VTE Prophylaxis Timing <= 48 Hours
Cohort - TBI
1/1/18 - 12/7/18



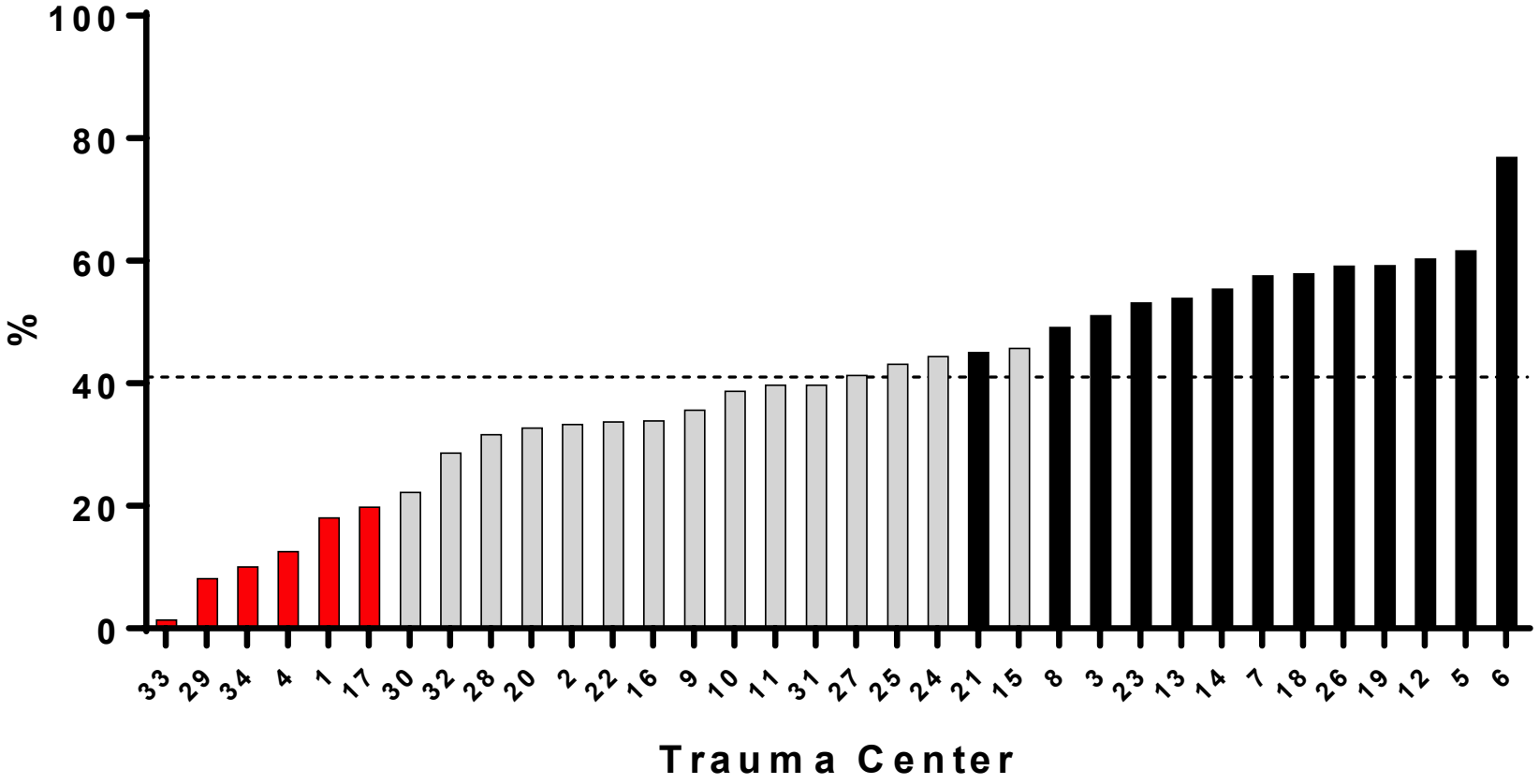
VTE Prophylaxis Timing <= 48 Hours, LMWH
Cohort - TBI
1/1/18 - 12/7/18



VTE Prophylaxis Timing <= 48 Hours
Cohort - Spine Injury
1/1/18 - 12/7/18



VTE Prophylaxis Timing <= 48 Hours, LMWH
Cohort - Spine Injury
1/1/18 - 12/7/18



Outcomes in Trauma Patients on Anticoagulation and/or Antiplatelet Therapy

Wendy Wahl

Association of Mortality among Trauma Patients Taking Pre-Injury Direct Oral Anticoagulants vs. Vitamin K Antagonists

Zachary Laduke, Pharm D, Jason P. Hecht, Pharm D, Anne Cain-Nielson, MS,
Mark R. Hemmila, MD, FACS, Wendy L. Wahl, MD, FACS, FCCM

Disclosure Statement of Financial Interest

Zachary Laduke, Jason Hecht, and Wendy Wahl have nothing to disclose

Mark Hemmila and Anne Cain-Nielsen receive salary support from Blue Cross Blue Shield of Michigan and Blue Care Network for the administration of the Michigan Trauma Quality Improvement Program

The funding organization had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

Background

- Pre-injury warfarin has been shown to increase morbidity and mortality despite effective reversal agents[1-3]
- Direct oral anticoagulants (DOACs) have been shown to have significantly less spontaneous major bleeding events compared to warfarin[4-8]
- Prior studies of outcomes following traumatic injury in patients on pre-injury DOACs are limited mostly to single center studies or isolated traumatic injuries[9-11]

1. Batchelor JS, et al. *Br J Neurosurg.* 2012;26(4):525-30.
2. Grandhi R, et al.. *J Trauma.* 2015;78(3):614-21.
3. Ivascu FA, et al. *J Trauma.* 2005;59:1131-1139.
4. Inohara T, et al. *JAMA.* 2018;319(5):463-473.
6. Granger CB, et al. *N Engl J Med.* 2011;365(11):981-92
7. Giugliano RP, et al. *N Engl J Med.* 2013;369(22):2093-104.
8. Patel MR, et al. *N Engl J Med.* 2011;365(10):883-91.
11. Maung AA, et al. *J Trauma.* 2016;81(4):652-7.

Hypothesis

Traumatically injured patients on pre-injury DOACs will have lower mortality and complications than those patients injured while taking VKAs

Study Design

- Multicenter retrospective cohort study of 29 trauma centers in the Michigan Trauma Quality Improvement Program (MTQIP) registry
- Cohorts were stratified by pre-injury anticoagulation and antiplatelet agents
- Study dates: January 2012 – December 2017

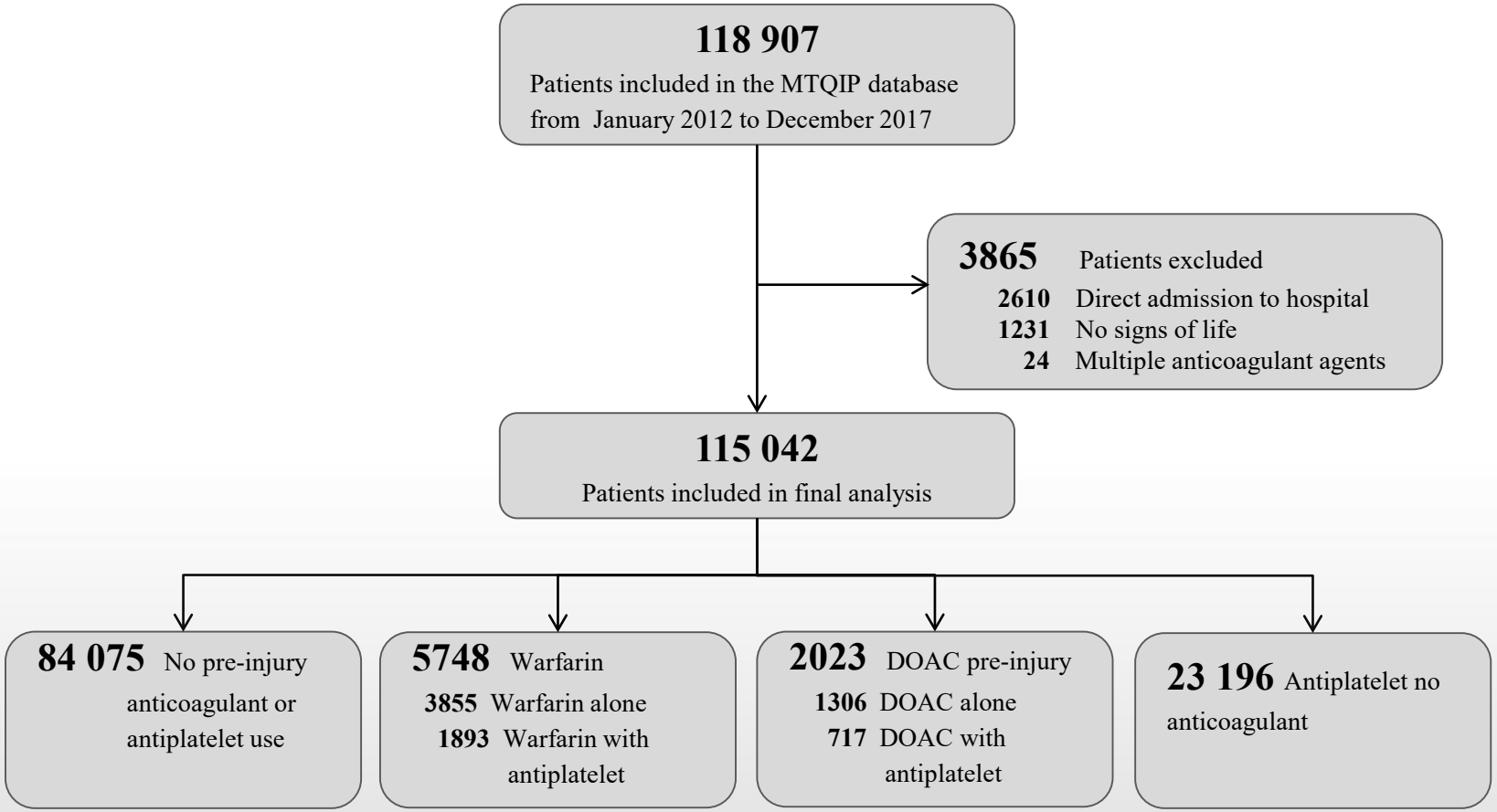
Inclusion Criteria	Exclusion Criteria
• Age ≥ 16 years old • Trauma code on admission • Injury Severity Score (ISS) ≥ 5	• No signs of life on initial evaluation • Direct hospital – hospital transfer • Multiple anticoagulant agents

Statistical Analysis

- Multivariate logistic regression modeling used to account for differences in characteristics
- Goodness-of-fit was assessed and validated using c-statistics
- Primary Outcome:
  - Mortality or discharge to hospice
- Secondary Outcomes:
  - Serious in-hospital complications[1]
  - Resource utilization (ORs, transfusion in first 4 hours)

1. Hemmila MR, et al. *J Trauma*. 2017;82:867-876.

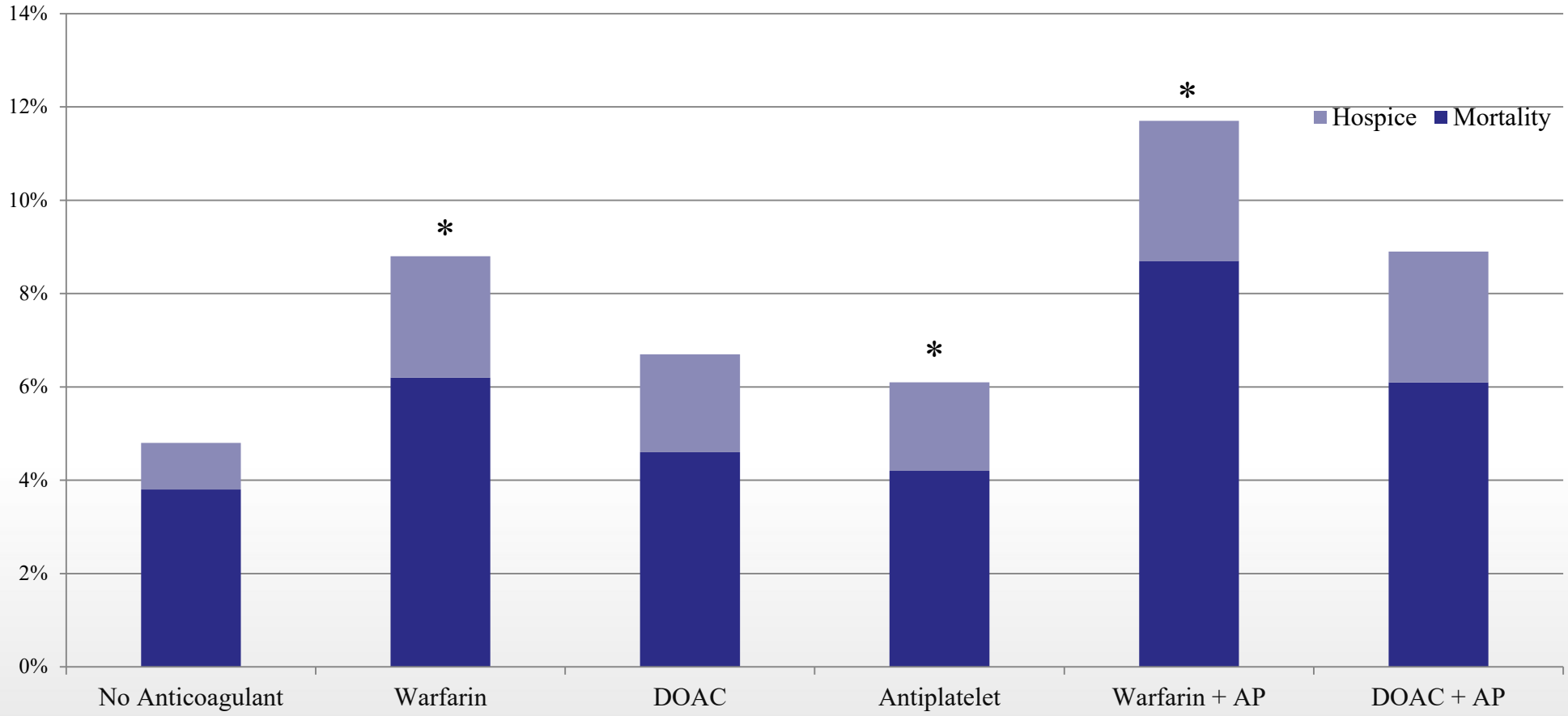
Study Population



Demographics

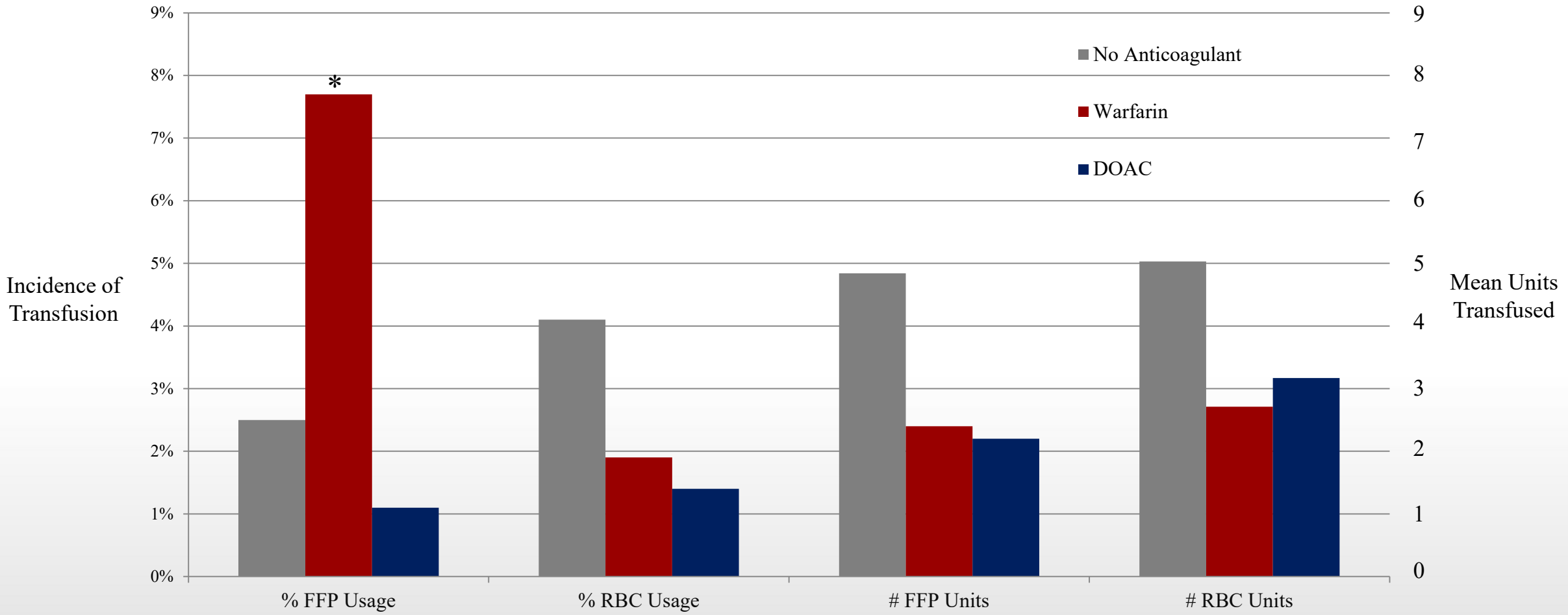
	None (N=84075)	Warfarin (N=3855)	DOAC (N=1306)	p value
Age, years ± SD	52.7 ± 22.8	77.7 ± 13.2	77.1 ± 13.1	<0.001
Female, No. (%)	34129 (40.6)	2104 (54.6)	761 (58.3)	<0.001
White, No. (%)	62109 (73.9)	3535 (91.7)	1222 (93.6)	<0.001
Uninsured, No. (%)	9421 (11.2)	65 (1.7)	15 (1.1)	<0.001
Penetrating trauma, No. (%)	7046 (8.4)	24 (0.6)	4 (0.3)	<0.001
Injury Severity Score, No. (%)				
5-15	66742 (79.4)	3179 (82.5)	1134 (86.8)	
16-24	10650 (12.7)	379 (9.8)	106 (8.1)	<0.001
25-35	5204 (6.2)	283 (7.3)	59 (4.5)	
>35	1479 (1.8)	14 (0.4)	7 (0.5)	
AIS >2, No. (%)				
Head/neck	16681 (19.8)	929 (24.1)	248 (19.0)	<0.001
Chest	14922 (17.7)	448 (11.6)	173 (13.2)	
GCS – Motor, No. (%)				
6	71289 (84.8)	3267 (84.7)	1111 (85.1)	<0.001
5-2	4101 (4.9)	122 (3.2)	28 (2.1)	
1	3382 (4.0)	75 (1.9)	13 (1.0)	
Ventilator Support, No (%)	34825 (41.4)	1467 (38.1)	522 (40.0)	<0.001
Comorbid diseases, No. (%)				
Cerebrovascular accident	1004 (1.2)	220 (5.7)	110 (8.4)	
COPD	6463 (7.7)	611 (15.8)	211 (16.2)	
Chronic renal failure	711 (0.8)	131 (3.4)	20 (1.5)	
Congestive heart failure	1521 (1.8)	477 (12.4)	131 (10.0)	<0.001
Diabetes	8094 (9.6)	845 (21.9)	271 (20.8)	
Functionally dependent	5916 (7.0)	833 (21.6)	439 (33.6)	
Hypertension	24055 (28.6)	2658 (68.9)	930 (71.2)	

Mortality or Hospice



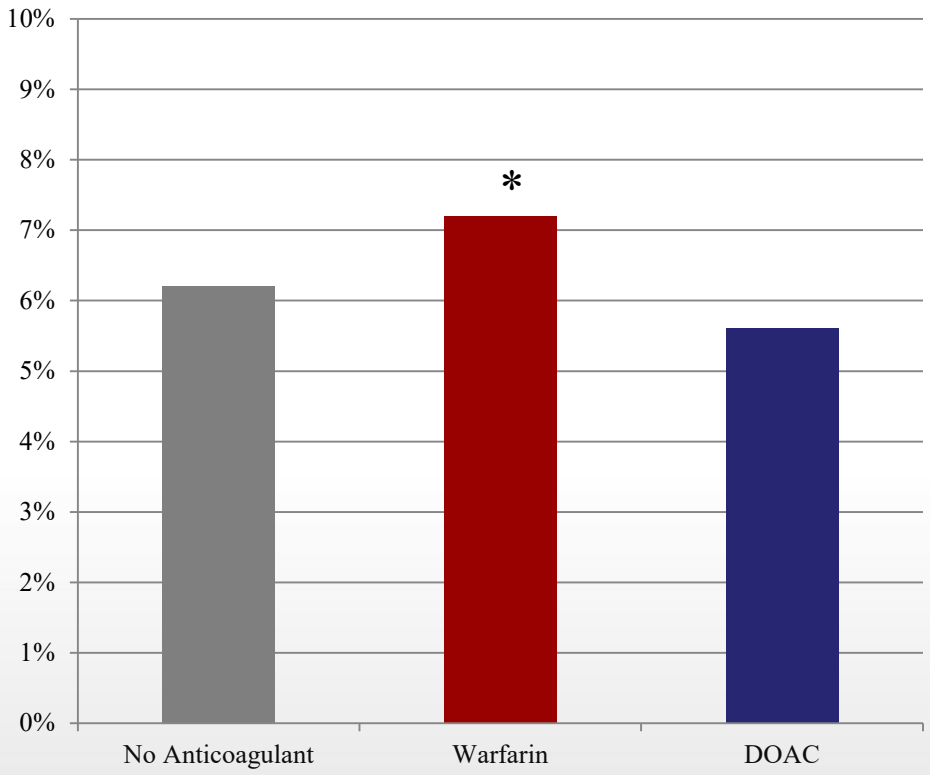
	No Anticoagulant	Warfarin	DOAC	Antiplatelet	Warfarin + AP	DOAC + AP
AOR (95% CI)	Reference	1.23 (1.04 – 1.44)	1.05 (0.81 – 1.71)	1.12 (1.01 – 1.24)	1.44 (1.10 – 1.88)	1.21 (0.90 – 1.63)

Resource Utilization



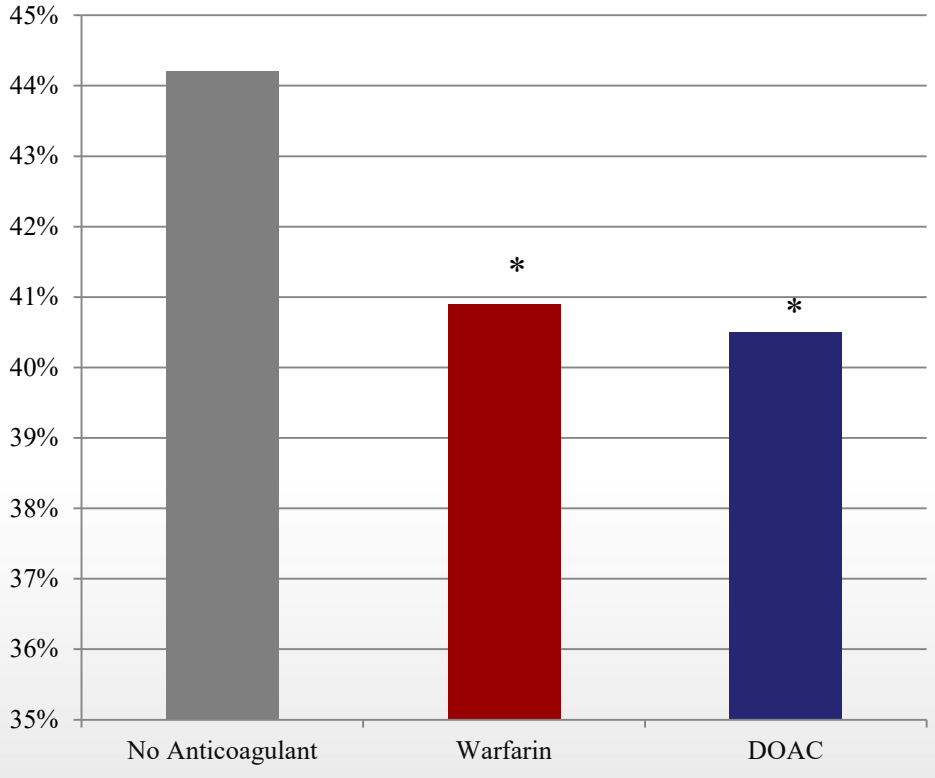
Resource Utilization

Serious Complications



Reference	1.19 (1.00 – 1.42)	1.03 (0.74 – 1.44)

Surgical Intervention



Reference	0.69 (0.56 – 0.85)	0.59 (0.47 – 0.73)

Study Limitations

- Unable to randomize patients prior to their traumatic injuries
- Reversal agents outside of blood products were not recorded in the registry until 2018
- Data was from level 1 and 2 trauma centers in Michigan so may not be applicable to other regions or classification of trauma systems
- Unable to account for patient frailty and potential biased prescribing towards warfarin
- Did not look at specific DOAC agents

Conclusions

- Compared to no anticoagulation, patients taking warfarin prior to traumatic injury have a higher incidence of mortality or hospice and serious complications
- Pre-injury DOAC was not associated with any difference in hospital outcomes as compared to no anticoagulation
- Pre-injury antiplatelet therapy alone and in combination with warfarin worsened outcomes
- This study contributes to the growing body of evidence showing the superior safety profiles of DOACs as compared to warfarin

Reviewer's comments

What about severely injured patients with high AIS?

How did the different DOAC agents do? Do factor IIa inhibitors (thrombin inhibitors) perform differently than Xa inhibitors?

Mortality/Discharge to Hospice for AIS of 3-5

Group	Odds Ratio [95% CI]	P value
Antiplatelet agent only	1.15 [1.03-1.28]	0.011
Warfarin+antiplt agent	1.39 [1.07-1.80]	0.012
Warfarin only	1.34 [1.137-1.60]	0.001
DOAC+antiplt agent	1.32 [0.996-1.75]	0.053
DOAC only	1.20 [0.86-1.68]	0.275

Serious Complications for AIS 3-5

Group	Odds Ratio [95% CI]	P value
Antiplatelet agent only	1.16 [1.05-1.26]	0.001
Warfarin+antiplt agent	1.29 [1.03-1.60]	0.021
Warfarin only	1.19 [0.998-1.41]	0.052
DOAC+antiplt agent	1.02 [0.68-1.51]	0.916
DOAC only	1.08 [0.81-1.43]	0.583

DOAC Comparison

group_split	Freq.	Percent	Cum.
Antiplatelet Only	23,196	20.16	20.16
Coumadin + Antiplatelet	1,893	1.65	21.81
Coumadin Only	3,855	3.35	25.16
Direct thrombin + Antiplatelet	137	0.12	25.28
Direct thrombin only (IIa inh)	197	0.17	25.45
Factor Xa + Antiplatelet	580	0.50	25.95
Factor Xa only	1109	0.96	26.92
None	84,075	73.08	100.00
Total	115,042	100.00	

Mortality/Discharge to Hospice for DOACs, Warfarin, Antiplatelet Agents Compared to None

Group	Odds Ratio [95% CI]	P value
Antiplatelet agent only	1.11 [1.01-1.24]	0.033
Warfarin+antiplt agent	1.43 [1.10-1.87]	0.008
Warfarin only	1.22 [1.04-1.43]	0.013
Thrombin inhib (aIIa+antiplt)	2.26 [1.25-4.10]	0.007
Thrombin inhib (anti-IIa)	1.09 [0.55-2.16]	0.785
Factor Xa inhibitor+antiplt	0.98 [0.70-1.3]	0.920
Factor Xa inhibitor only	1.04 [0.78-1.39]	0.758

Summary

- Patients on DOACs appear to have better outcomes than those on VKAs
- There appear to be differences among the types of DOACs, with Xa inhibitors associated with better outcomes
  - Small numbers
  - Platelet effect?

Summary

- The timing of reversal agents and which agents were used was not known for most of the study time period
  - More study will help us elucidate how to manage our injured patients on anticoagulants and antiplatelet agents

Thanks to all the MTQIP members!

Analytics Update

Jill Jakubus, PA-C

Participant Agreement Update

Rationale

- Updated standard for CQI's
- Expansion of services
- Requested clarification

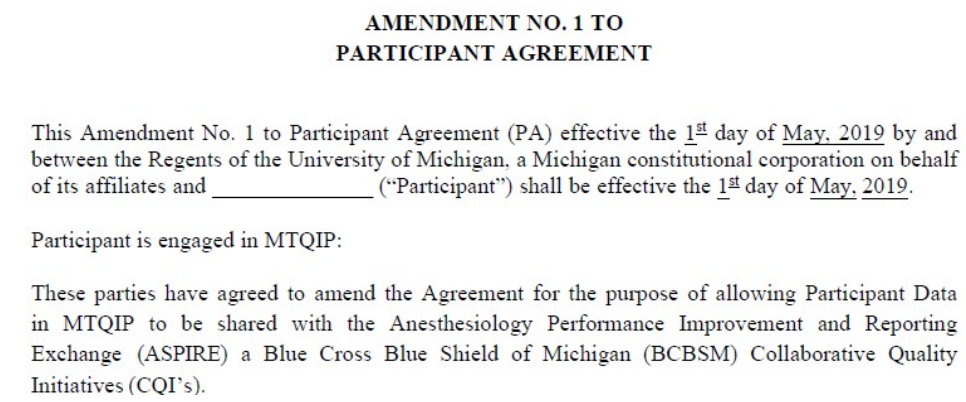
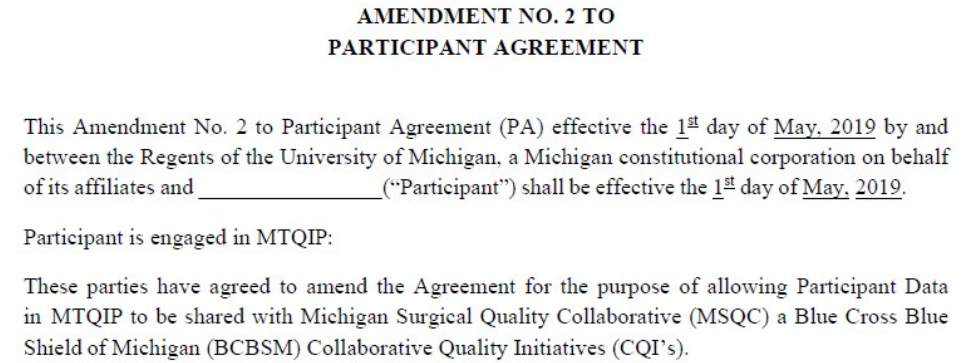
Timeline

- May release

Questions

- jjakubus@med.umich.edu

Agreement Components	Purpose	Notes
Participation Agreement This Participation Agreement is effective the 1st day of May, 2019, by and between _____, located in _____, Michigan (hereinafter referred to as "PARTICIPANT") and the Regents of the University of Michigan, a Michigan constitutional corporation located in Ann Arbor, Michigan for the benefit of the Michigan Trauma Quality Improvement Program, (hereinafter referred to as "MTQIP"),	**Uses of data set**	**Replacing data use agreement**
Exhibit A **ELIGIBILITY AND EXPECTATIONS** **Participating Hospital Eligibility Requirements** **In order to be considered for participation in MTQIP a hospital must:** I. Operate an adult trauma program. II. Possess American College of Surgeons (ACS) Level 1 or 2 adult trauma center verification.	**Eligibility and expectations**	**Submission of all records clarified**
Exhibit B **HIPAA BUSINESS ASSOCIATE AGREEMENT** **THIS HIPAA BUSINESS ASSOCIATE AGREEMENT** ("BAA") is entered into effective the 1st day of May, 2019 ("Effective Date"), by and between __("Covered Entity"), and the Regents of the University of Michigan, a Michigan constitutional corporation for the benefit of the University of Michigan Coordinating Center for the Michigan Trauma Quality Improvement Program ("MTQIP") also referred to as ("Business Associate" "BA" or "UM").	**Use of PHI**	**New work with EMS linkage, patient reported outcomes, CQI sharing.**
Exhibit C **Limited Data Use Agreement** This data use agreement (the "Agreement") is by and between The Regents of the University of Michigan on behalf of its_____, ("UM") a Michigan constitutional corporation with its principal place of business in Ann Arbor, Michigan, and _____ ("Entity") and is effective as of _____ (the "Effective Date"). WHEREAS, UM and Entity are both engaged in research, public health, or other purposes permitted under 45 C.F.R. § 164.514(e):	**Allows use by of limited data sets by members**	

Agreement Components	Purpose	Notes
	**Sharing with anesthesia collaborative ASPIRE**	**Only sign if applicable**
	**Sharing with surgery collaborative MSQC**	**Only sign if applicable**

AMENDMENT NO. 1 TO
PARTICIPANT AGREEMENT

This Amendment No. 1 to Participant Agreement (PA) effective the 1st day of May, 2019 by and between the Regents of the University of Michigan, a Michigan constitutional corporation on behalf of its affiliates and _____ ("Participant") shall be effective the 1st day of May, 2019.

Participant is engaged in MTQIP:

These parties have agreed to amend the Agreement for the purpose of allowing Participant Data in MTQIP to be shared with the Anesthesiology Performance Improvement and Reporting Exchange (ASPIRE) a Blue Cross Blue Shield of Michigan (BCBSM) Collaborative Quality Initiatives (CQI's).

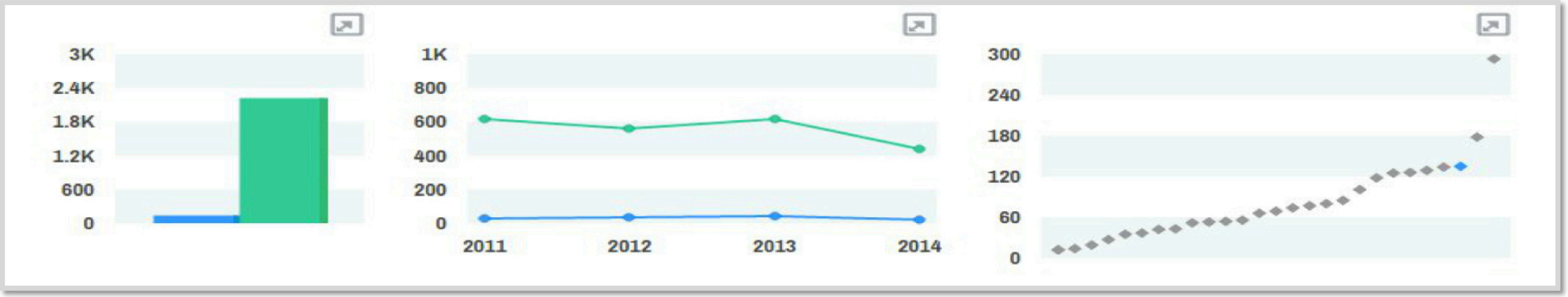
AMENDMENT NO. 2 TO
PARTICIPANT AGREEMENT

This Amendment No. 2 to Participant Agreement (PA) effective the 1st day of May, 2019 by and between the Regents of the University of Michigan, a Michigan constitutional corporation on behalf of its affiliates and _____("Participant") shall be effective the 1st day of May, 2019.

Participant is engaged in MTQIP:

These parties have agreed to amend the Agreement for the purpose of allowing Participant Data in MTQIP to be shared with Michigan Surgical Quality Collaborative (MSQC) a Blue Cross Blue Shield of Michigan (BCBSM) Collaborative Quality Initiatives (CQI's).

New Online Analytics – Open Fracture

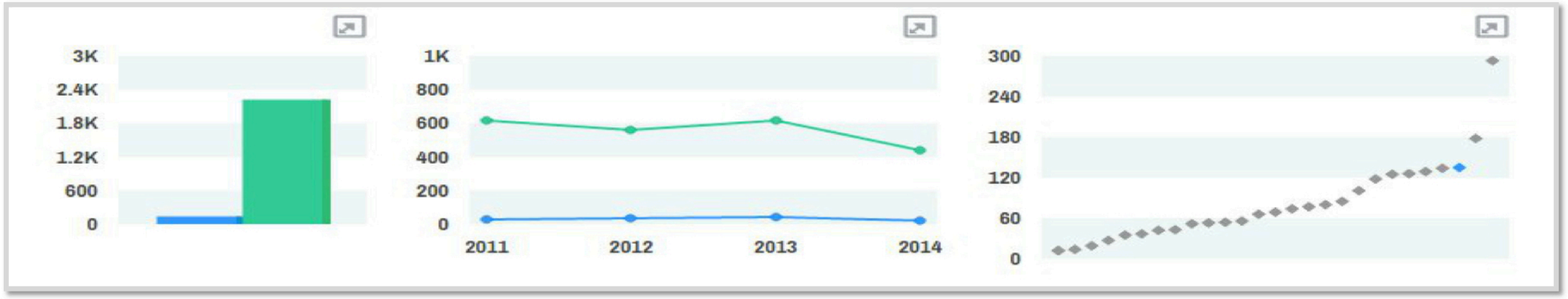


Practices > Open Fracture

Open Fracture Antibiotic Timing	Cases Numerator	Cases Demoninator	Hospital A - Unadj	MTQIP All - Unadj	P Value - Unadj
Missing Date or Time	N	N	#	#	
Time to Antibiotic Administration Mean Femur or Tibia (Hrs)	N	N	#	#	
Time to Antibiotic Administration Median Femur or Tibia (Hrs)	N	N	#	#	
<= 1 Hr Femur or Tibia (%)	N	N	#	#	
<= 1.5 Hr Femur or Tibia (%)	N	N	#	#	
<= 2 Hr Femur or Tibia (%)	N	N	#	#	
> 2 Hr Femur or Tibia (%)	N	N	#	#	
Time to Antibiotic Administration Mean Femur (Hrs)	N	N	#	#	
Time to Antibiotic Administration Median Femur (Hrs)	N	N	#	#	
<= 1 Hr Femur (%)	N	N	#	#	
<= 1.5 Hr Femur (%)	N	N	#	#	
<= 2 Hr Femur (%)	N	N	#	#	
> 2 Hr Femur (%)	N	N	#	#	
Time to Antibiotic Administration Mean Tibia (Hrs)	N	N	#	#	
Time to Antibiotic Administration Median Tibia (Hrs)	N	N	#	#	
<= 1 Hr Tibia (%)	N	N	#	#	
<= 1.5 Hr Tibia (%)	N	N	#	#	
<= 2 Hr Tibia (%)	N	N	#	#	
> 2 Hr Tibia (%)	N	N	#	#	

Status - UAT

New Online Analytics – Head CT



Practices > Head CT Metric

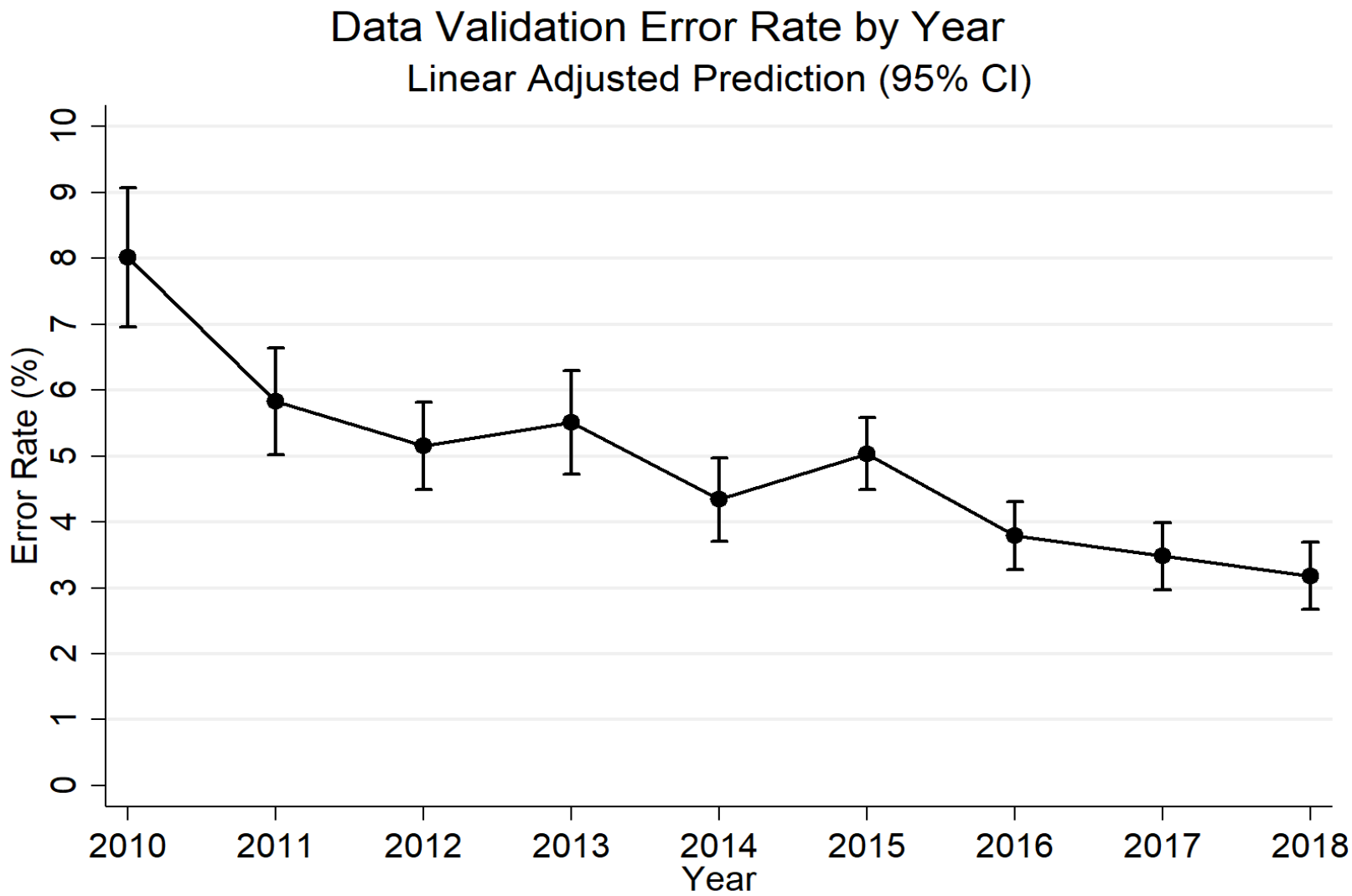
Head CT Timing - Traumatic Brain Injury on Anticoagulation	Cases Numerator	Cases Demoninator	Hospital A - Unadj	MTQIP All - Unadj	P Value - Unadj
Missing Date or Time	N	N	#	#	
Time to Head CT Scan in ED Mean (Hrs)	N	N	#	#	
Time to Head CT Scan in ED Median (Hrs)	N	N	#	#	
<= 0.5 Hr (%)	N	N	#	#	
<= 1 Hr (%)	N	N	#	#	
<= 1.5 Hr (%)	N	N	#	#	
<= 2 Hr (%)	N	N	#	#	
<= 4 Hr (%)	N	N	#	#	
> 4 Hr (%)	N	N	#	#	

Status - Development

The Future of Validation

- **Progress over time**
- **Share potential new approach**
- **Feedback May and June meetings**

The Future of Validation



n = 166 visits

What if we used each other's errors make us better?

The Future of Validation

CC - XXF fall transferring from recliner to WC > C1, C2 fx, forehead hematoma > non-op collar > aspirating > NPO/TF > change code status > ICD turned off > expired

Case Number	42163	
Trauma Center	UM	
Patient Reference		
ED Arrival		
Hospital Discharge		
Chart Selection Criteria	1	

M·TQIP

Review 1	SD
Review 2	JJ
Error Check	9

Activation Level	Consult	0	Consult
First ED Temperature	97.5	0	97.5
First ED HR	80	0	80
First ED SBP	157	0	157
Intubation Location	Never	0	Never
First ED GCS Eye	4	0	4
First ED GCS Verbal	5	0	5
First ED GCS Motor	6	0	6
ED/Hospital GCS Total	15	0	15
Admit Service	Trauma	0	Trauma
ED Disposition	ICU	2	Tele
ED Discharge Date	HD #1	0	HD #1
ED Discharge Time	AT + 45	0	AT +45
Trauma Surgeon NPI (Full and Partial Only)			
Provider Arrival Date (2017 Full Only)			.
Provider Arrival Time (2017 Full Only)			.

The Future of Validation

- **Collaborative validation**

- **Give to get**
- **Start small**

- **Transparency**
- **Obliterate the learning curve**

- **Feedback May/June meetings**

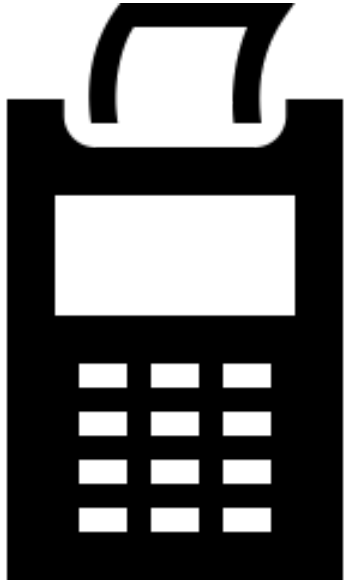
ASPIRE/MTQIP CQI Sharing Update

1. Bronson Healthcare – Kalamazoo
2. Henry Ford Health System – Detroit
3. Mercy Muskegon
4. Michigan Medicine
5. St. Mary Mercy – Livonia

Patient Reported Outcomes/App Update

App Built

IRB Application Submitted



Procurement Next

Research in Progress

Center	PI	Topic	Phase
Detroit Receiving	Oliphant	Not further specified: unclassified orthopedic injuries in trauma registries, cause for concern?	Presented Academic Surgical Congress (Feb 2019). Manuscript in progress
Henry Ford	Johnson	EMS vs. private car effect on outcomes	Analysis
Michigan Medicine	Wang	Injury prevention in vunerable populations	Analysis
Michigan Medicine	Jakubus	Data validation in benchmark reporting and modeling	Resubmission
Michigan Medicine	Goulet	Resource, outcomes, and care variation in IHF	Methods
Providence Hospital	Lopez	TXA in trauma	Analysis
Providence Hospital, Spectrum Health, St. Joseph Mercy, Michigan Medicine	Iskander, Lopez, Jakubus, Wahl	Optimal timing head CT's for geriatric falls	Analysis
Spectrum Health	Chapman	Outcomes in operative fixation of rib fractures	Propensity analysis
St. Joseph Mercy	Hecht	VTE type for trauma patients	Analysis

Program Manager Update

Judy Mikhail, PhD RN

Judy Mikhail, PhD, MBA,RN

MTQIP Program Manager Update

5-8-19

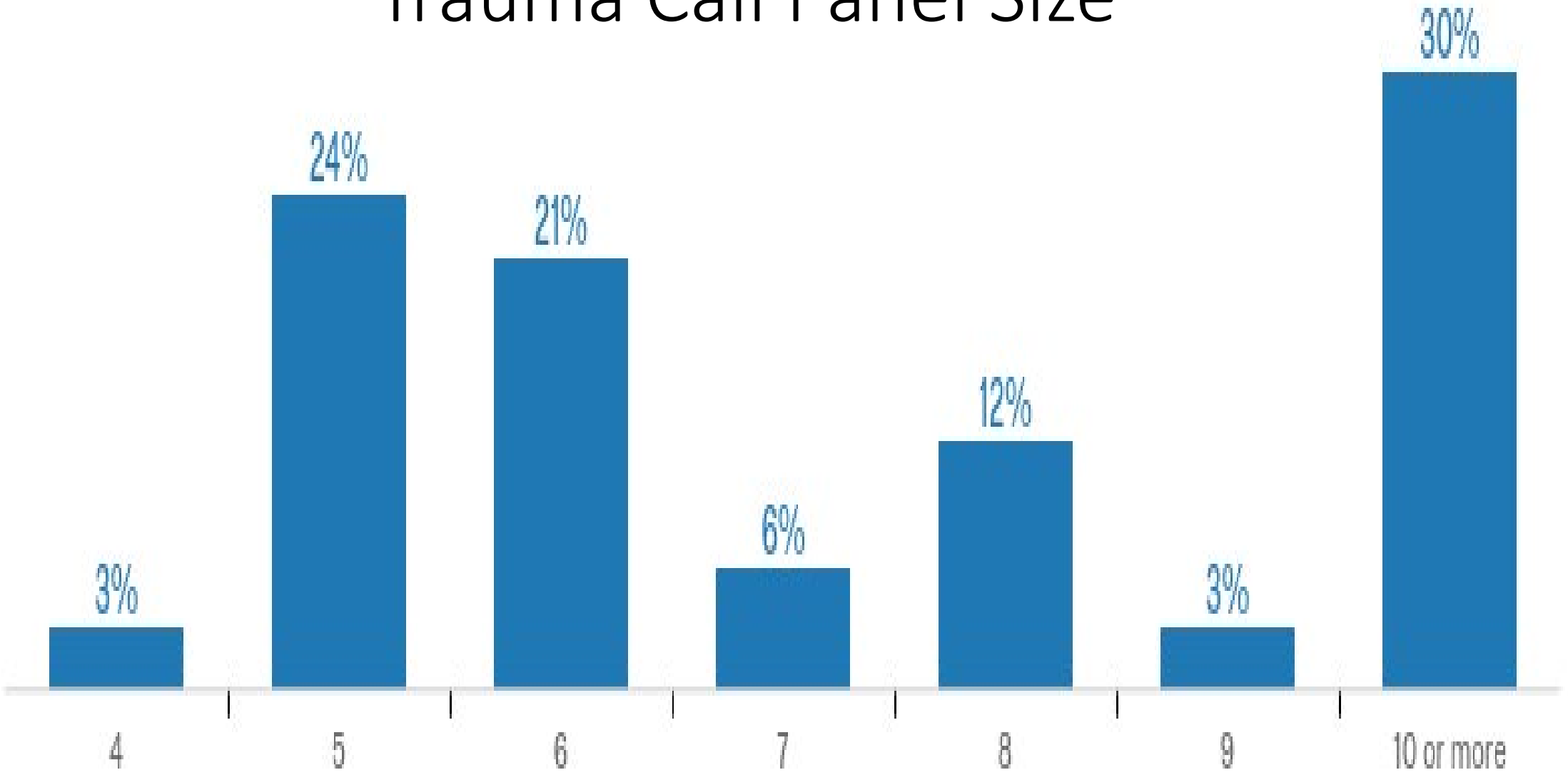
Emergency General Surgery Survey Results 2019

Resource Benchmarking Survey

First Performed 2012

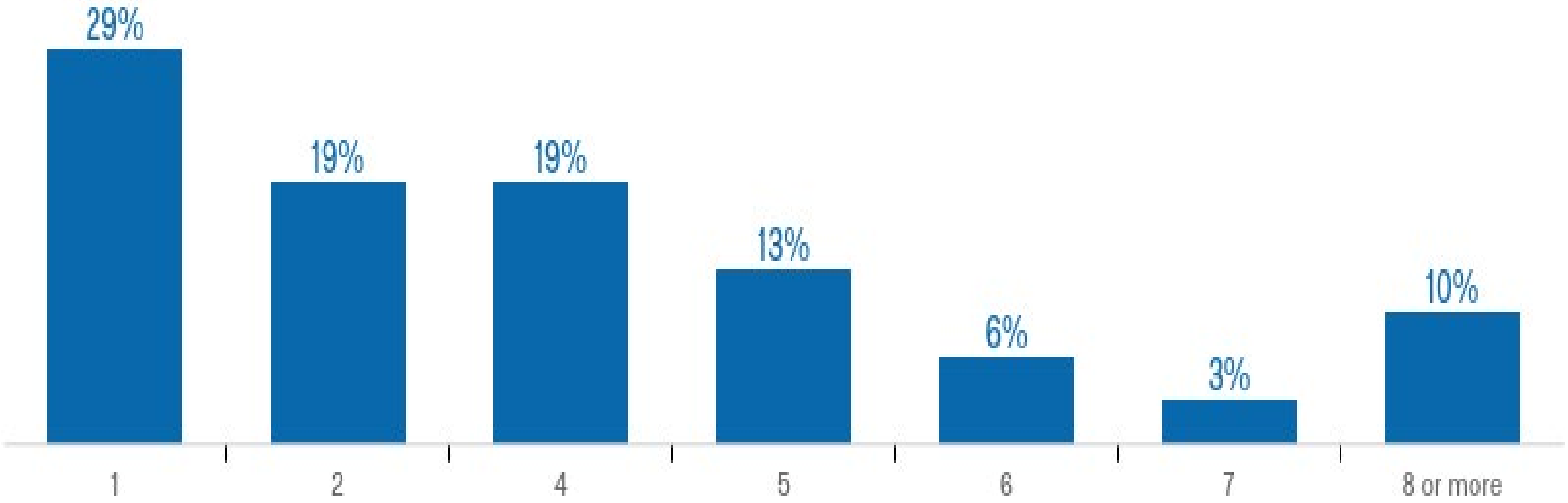
33/34 Surgeons Responded (97% Response Rate)

Trauma Call Panel Size



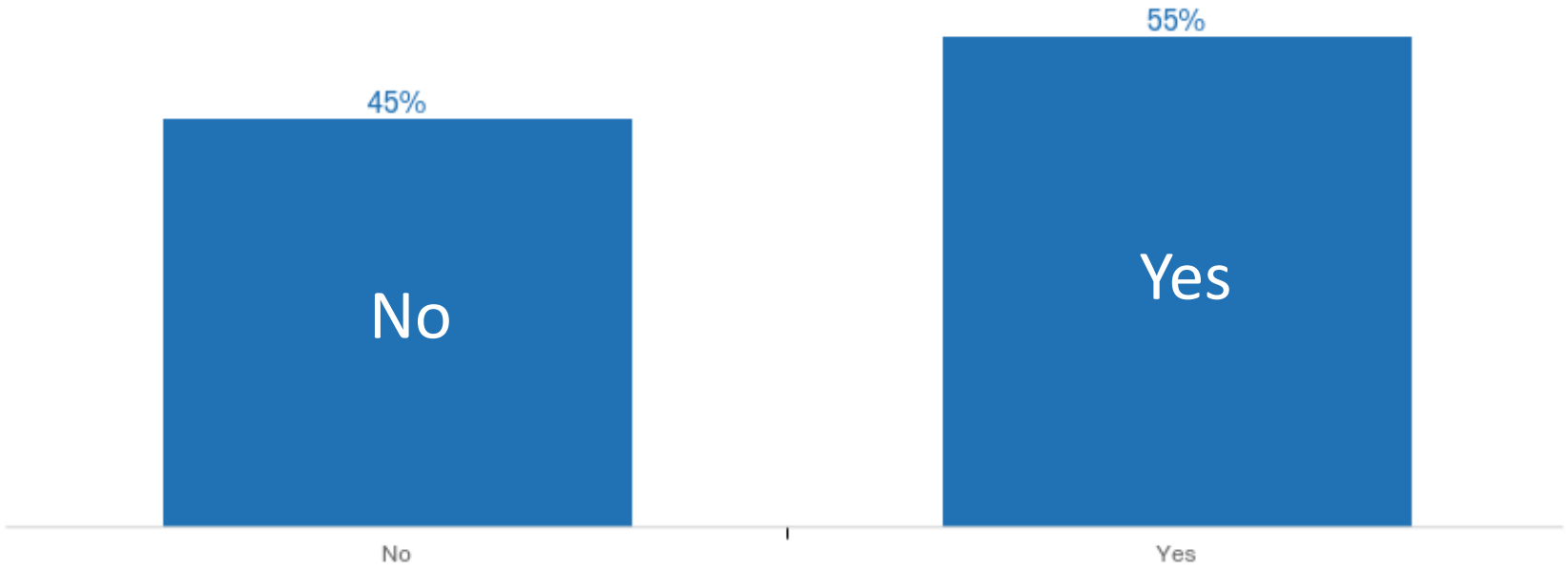
Number of Surgeons

Trauma Surgeon Call Panel Also Boarded in Critical Care

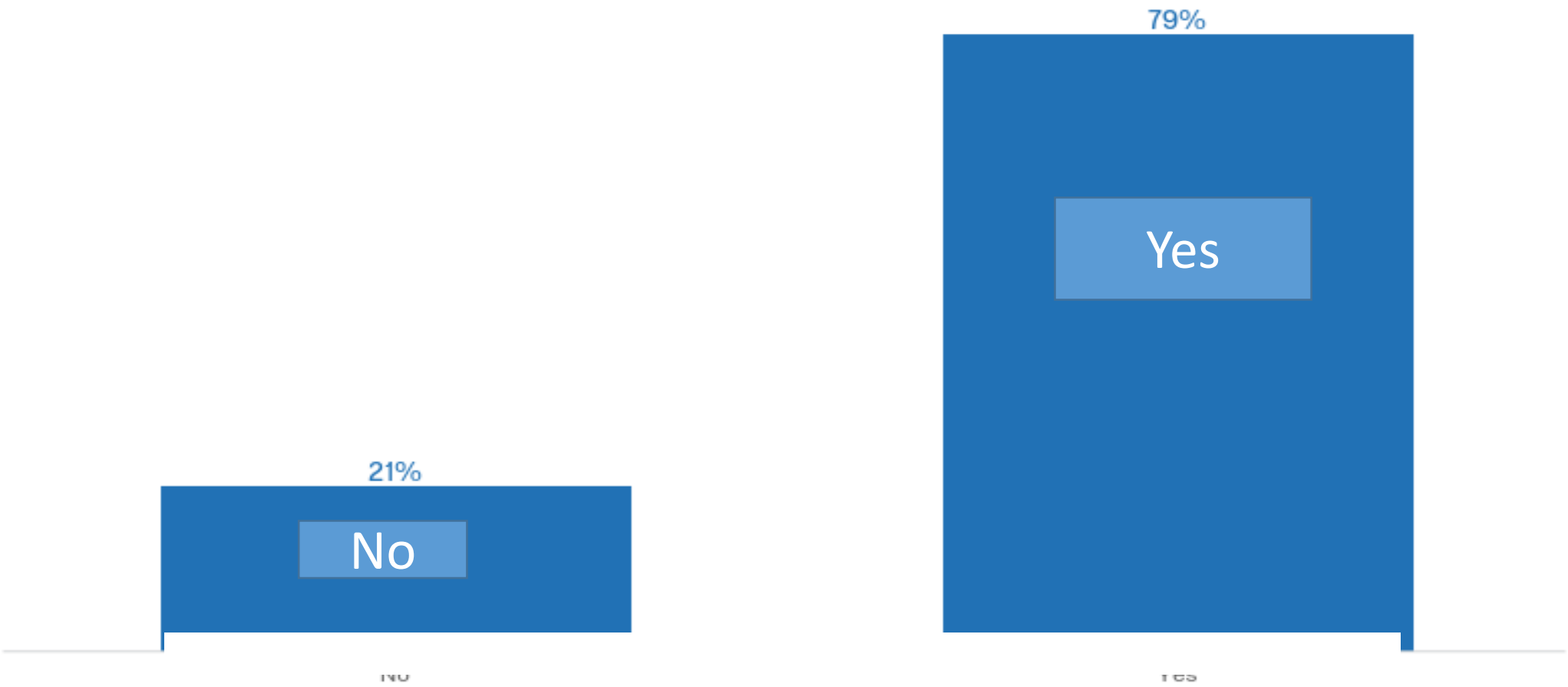


Critical Care Boarded Surgeons on Call Panel

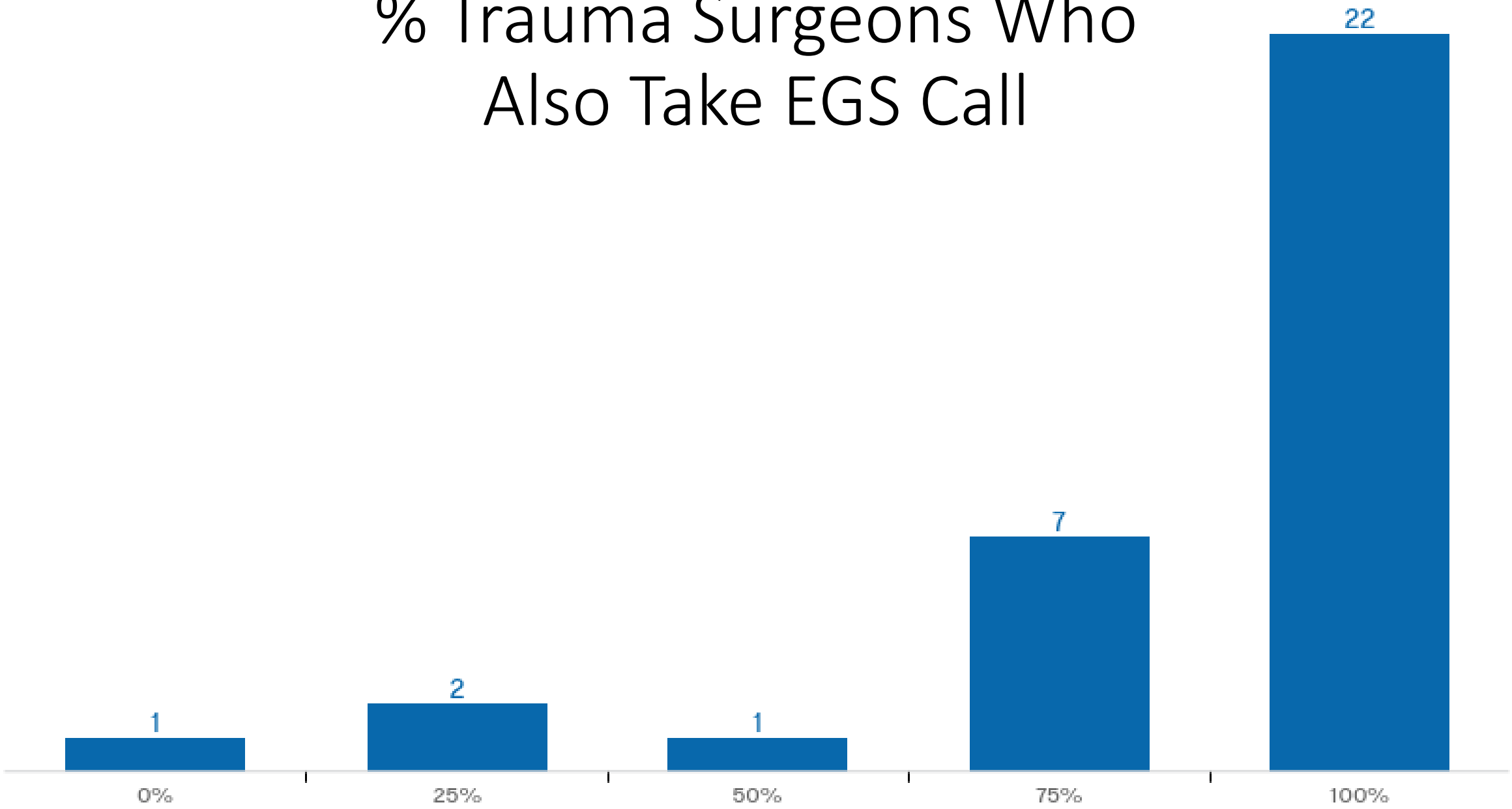
In House Trauma Call Required?



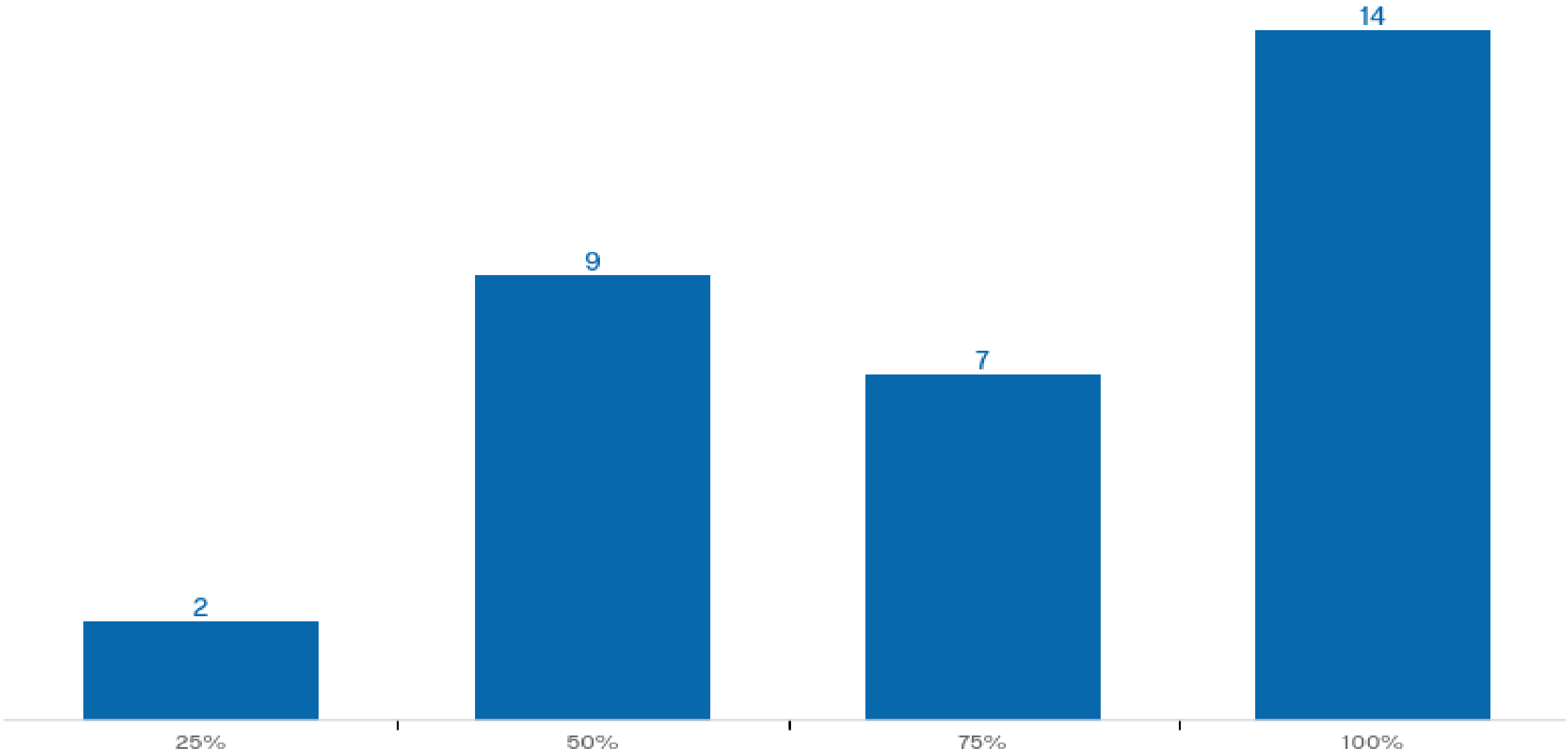
Simultaneous EGS & Trauma Call?



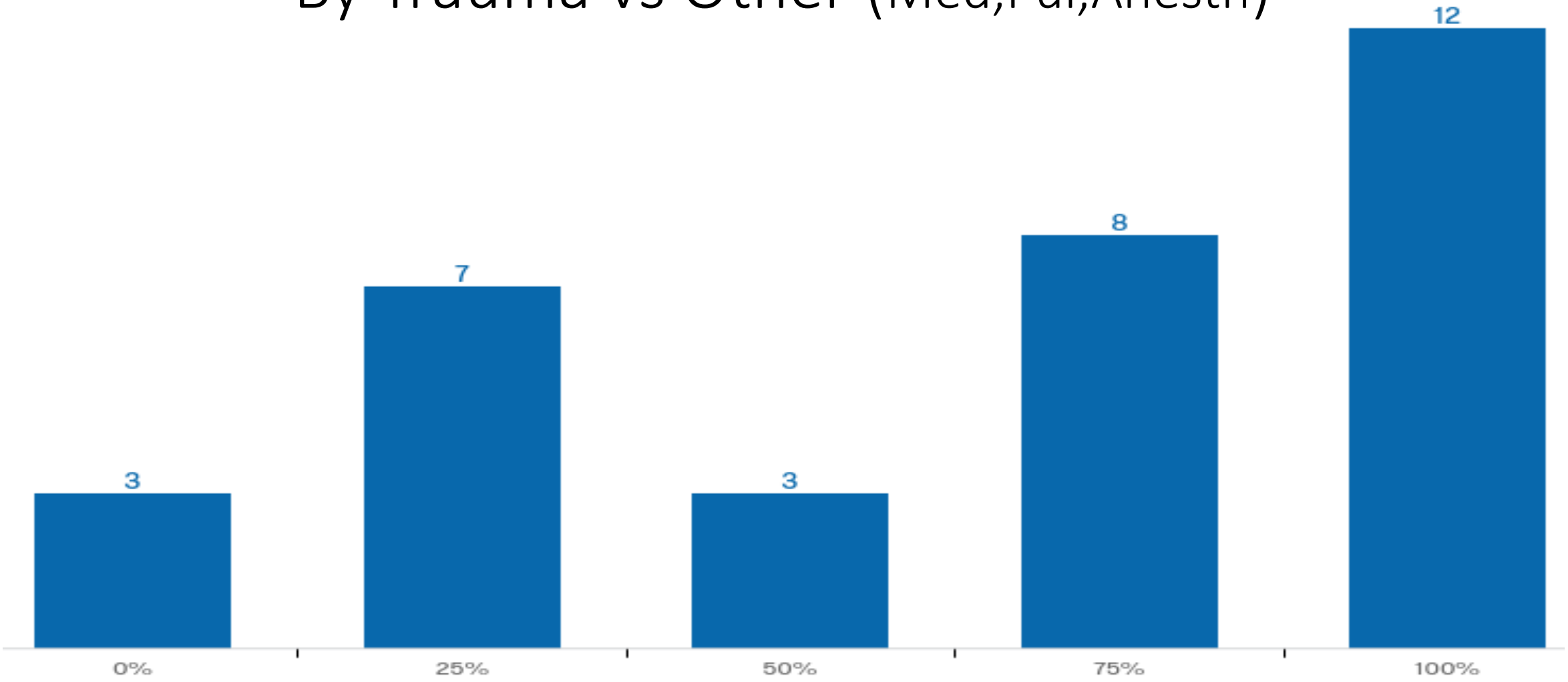
% Trauma Surgeons Who Also Take EGS Call



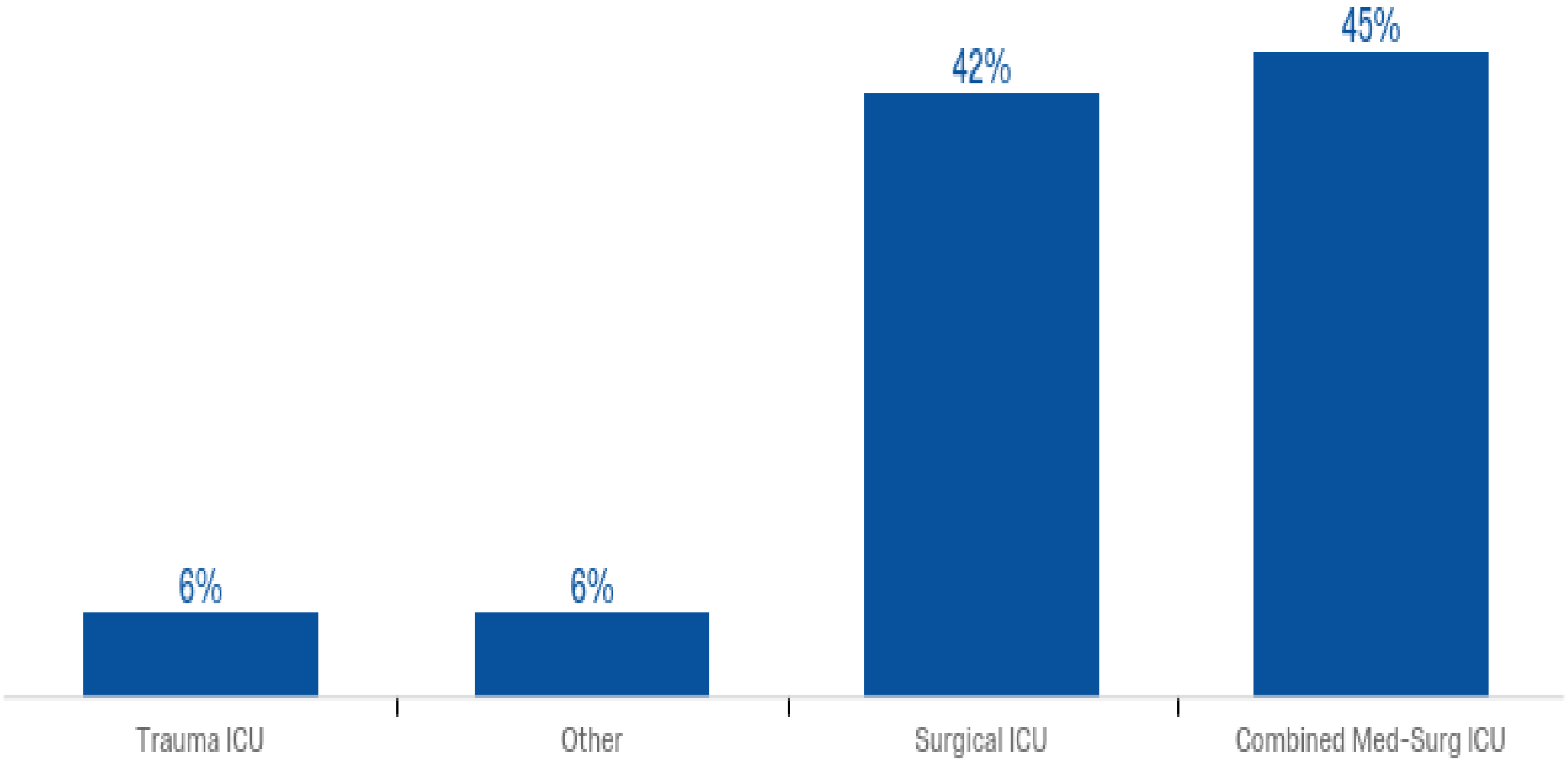
% Hospital EGS Call-Provided by Trauma



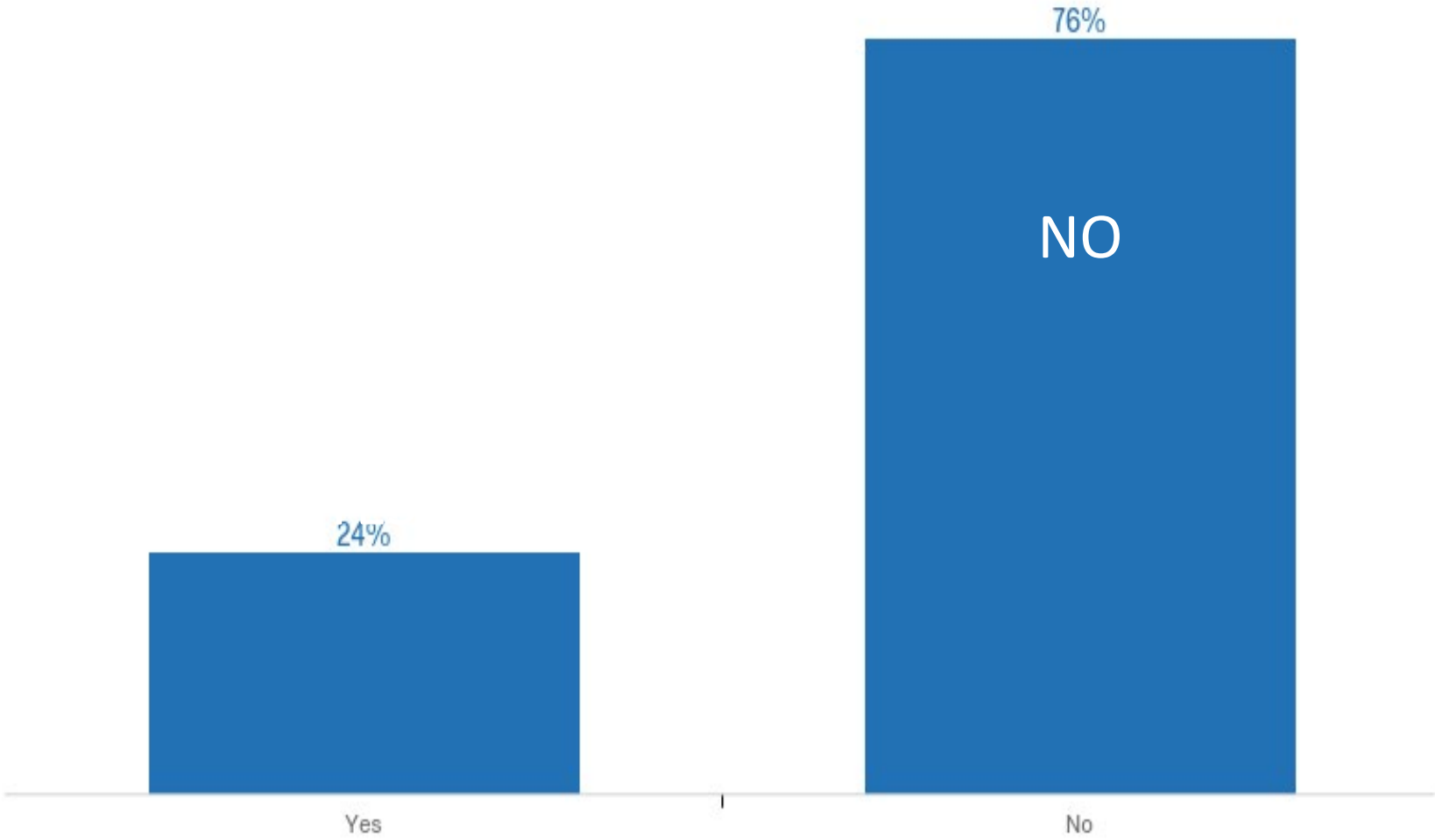
% EGS TR **ICU** Coverage
By Trauma vs Other (Med,Pul,Anesth)



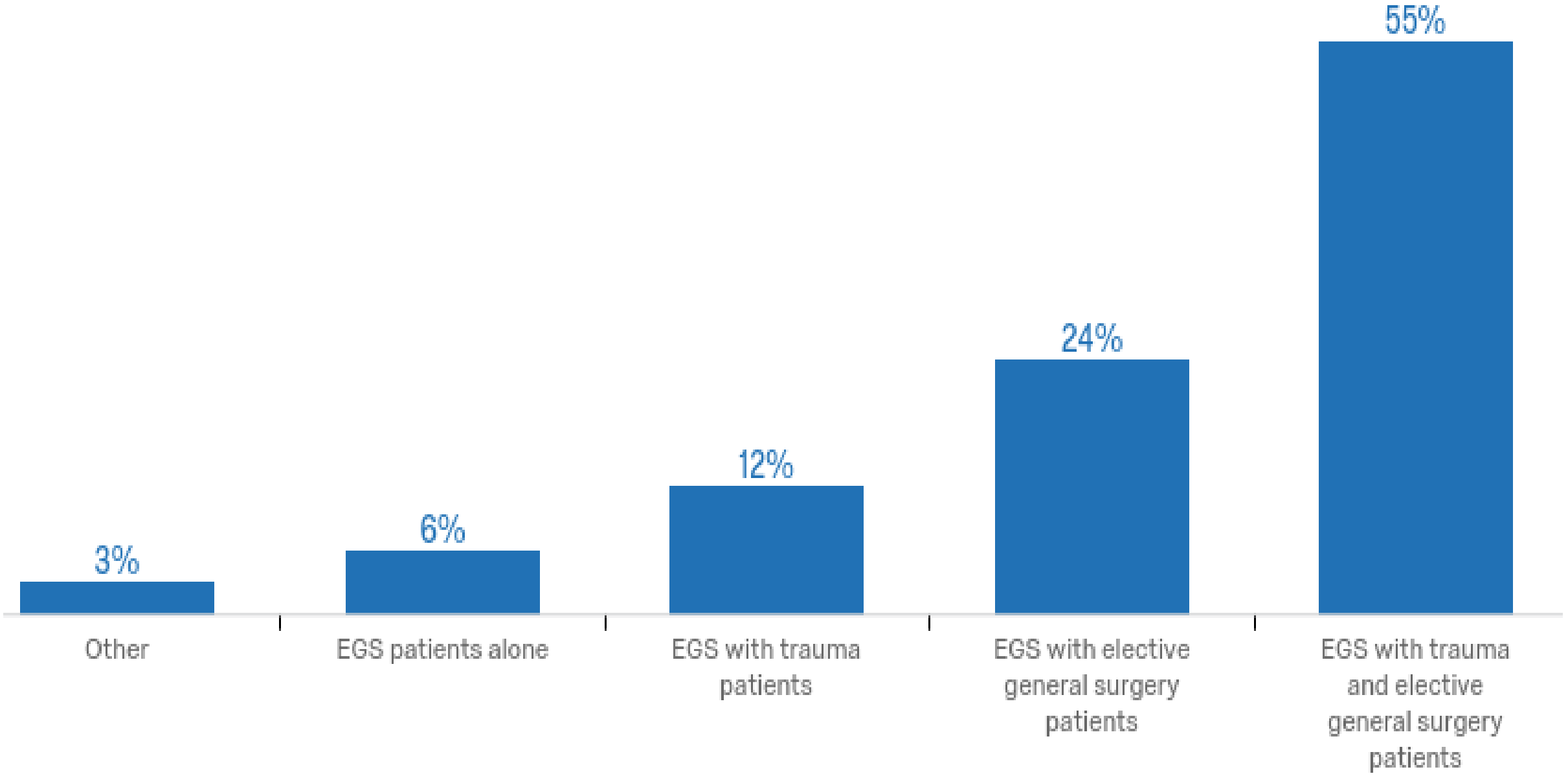
Hospital Critical Care Model for EGS



Closed ICU?



How Are EGS Patients Cohorted?



Future Measures Survey

BCBSM CQI Measure Requirements

- New
- Challenging
- One collaborative wide

Performance Measure Selection

- Pipeline planning
- Evidence based
- Valid data collection
- Clinically relevant
- Feasible
- Volume sensitive
- Fair but challenging
- What will help you with ACS Reviewers?

Future Measures Survey Results

n= 84/240

Response Rate 35%

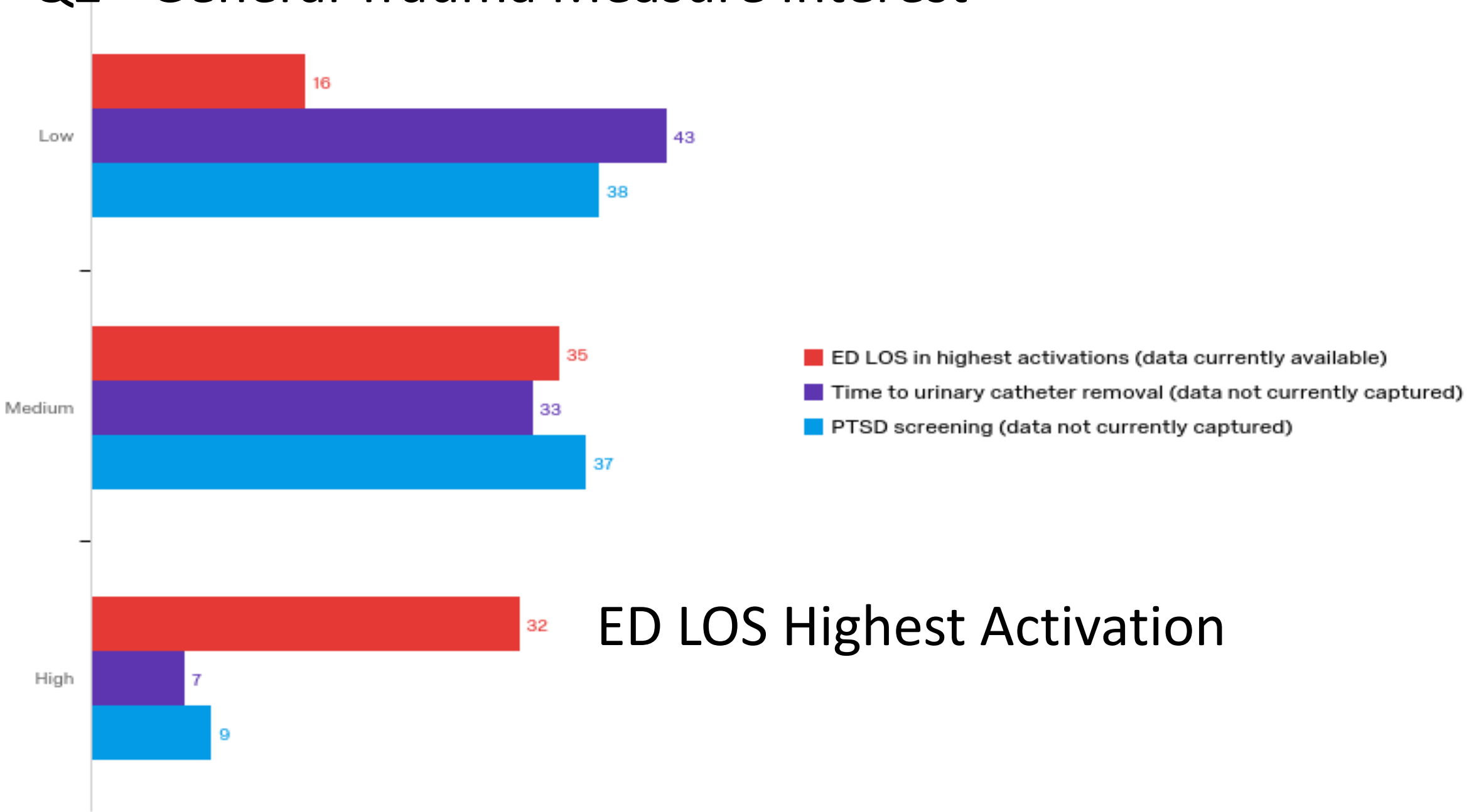
Where did this list of measures come from?

Literature Review

Q1 - Please indicate your discipline:

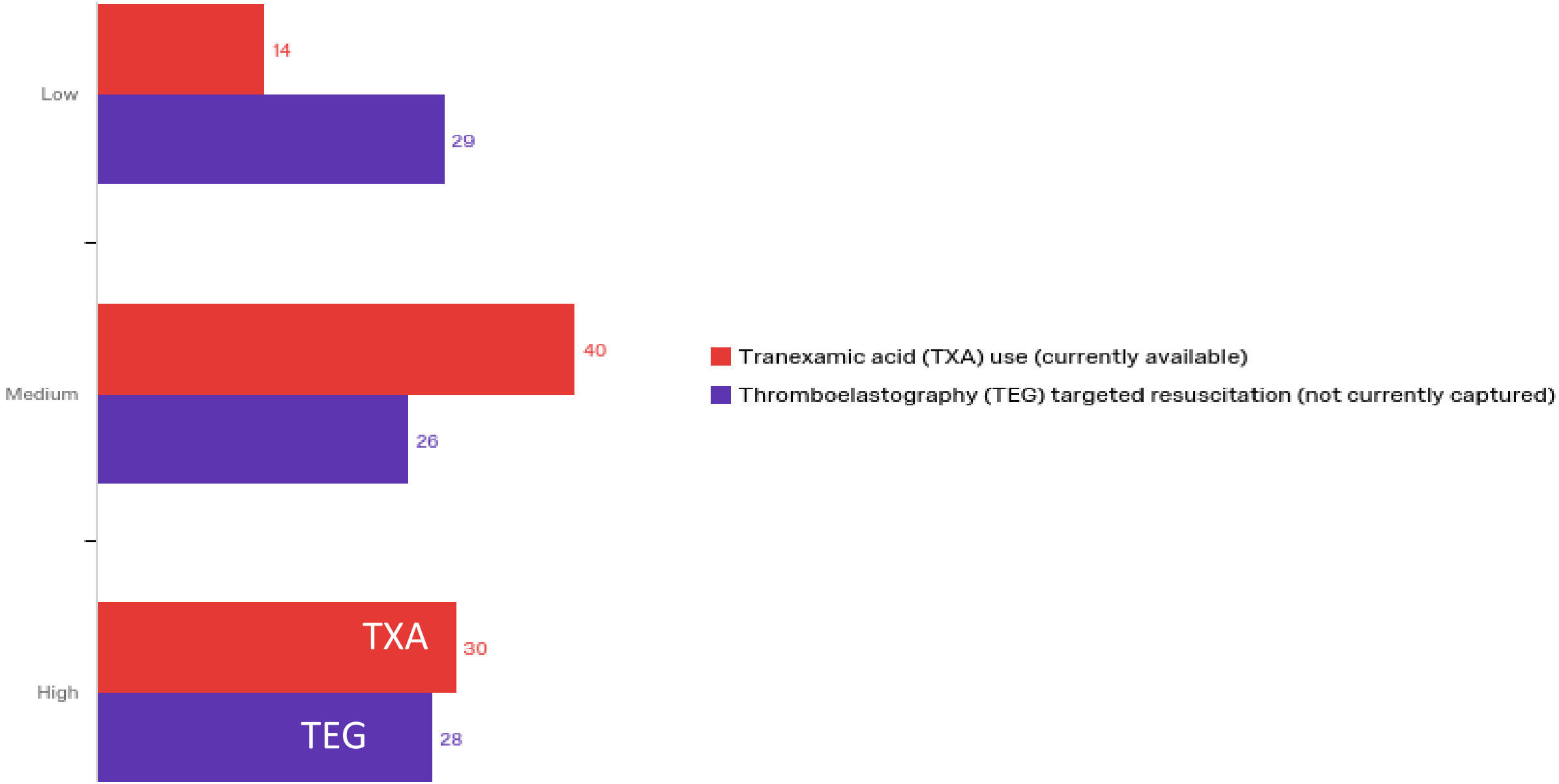
N=84

Q2 - General Trauma Measure Interest

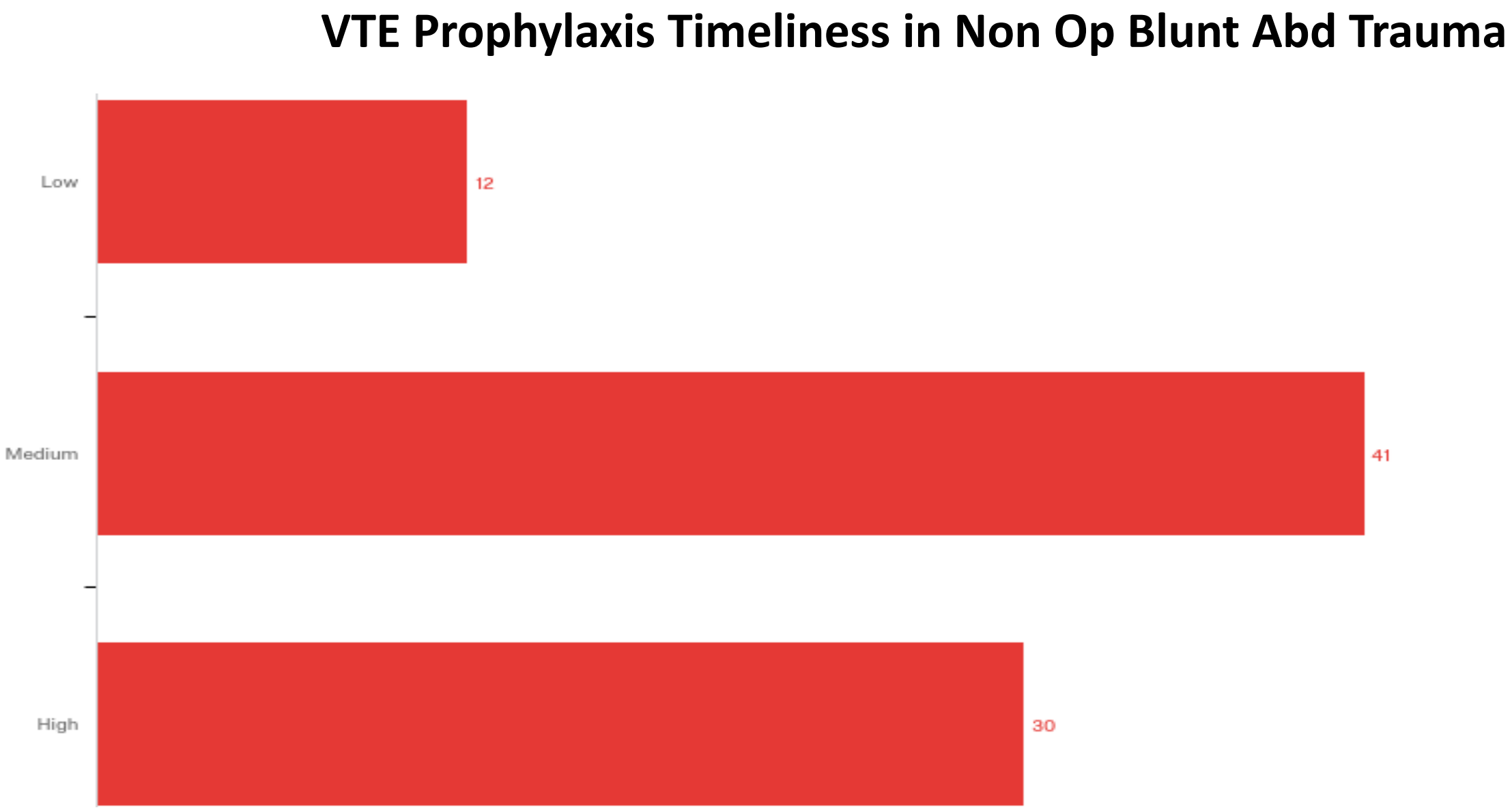


ED LOS Highest Activation

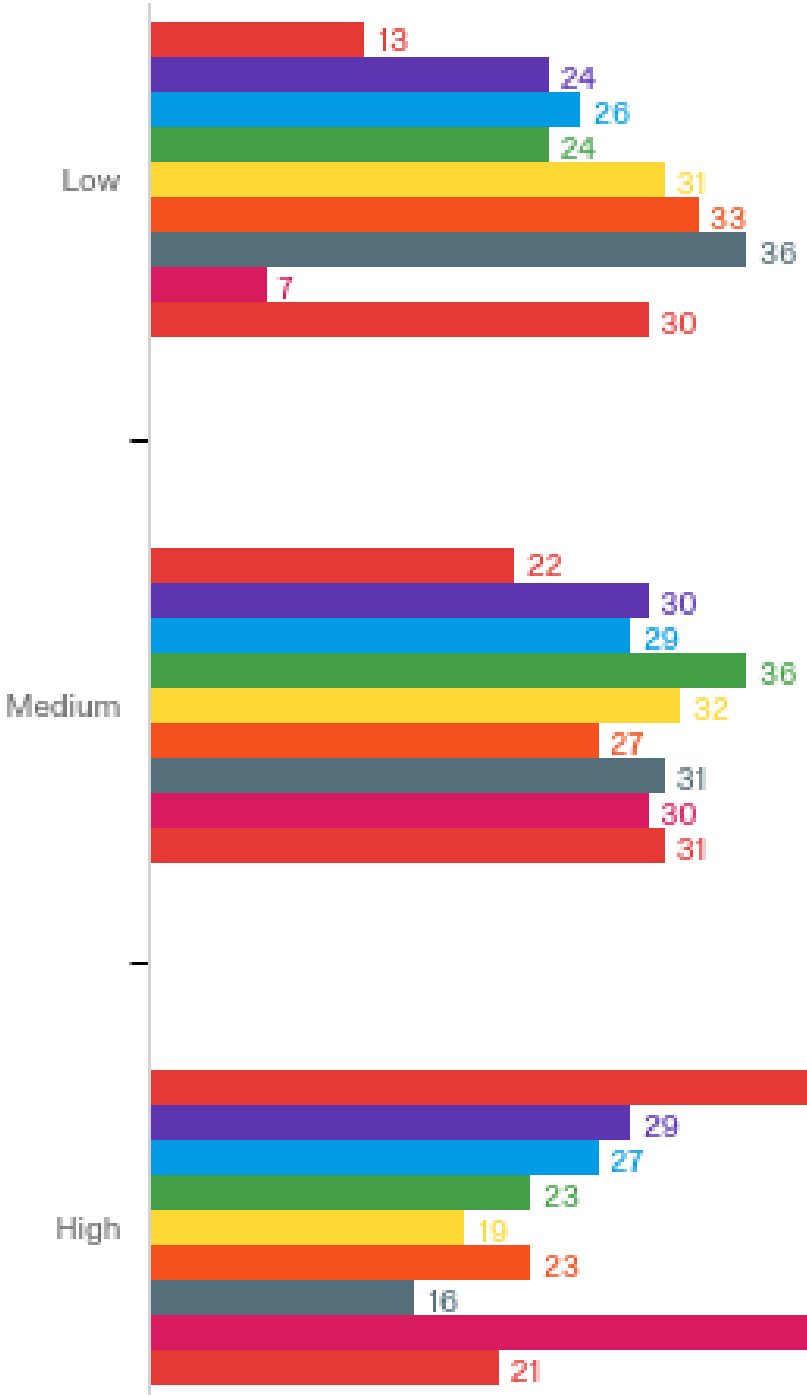
Q3 - Shock Measure Interest



Q4 - Abdominal Trauma Measure Interest



Q5 - Geriatric Hip Fracture Measure Interest

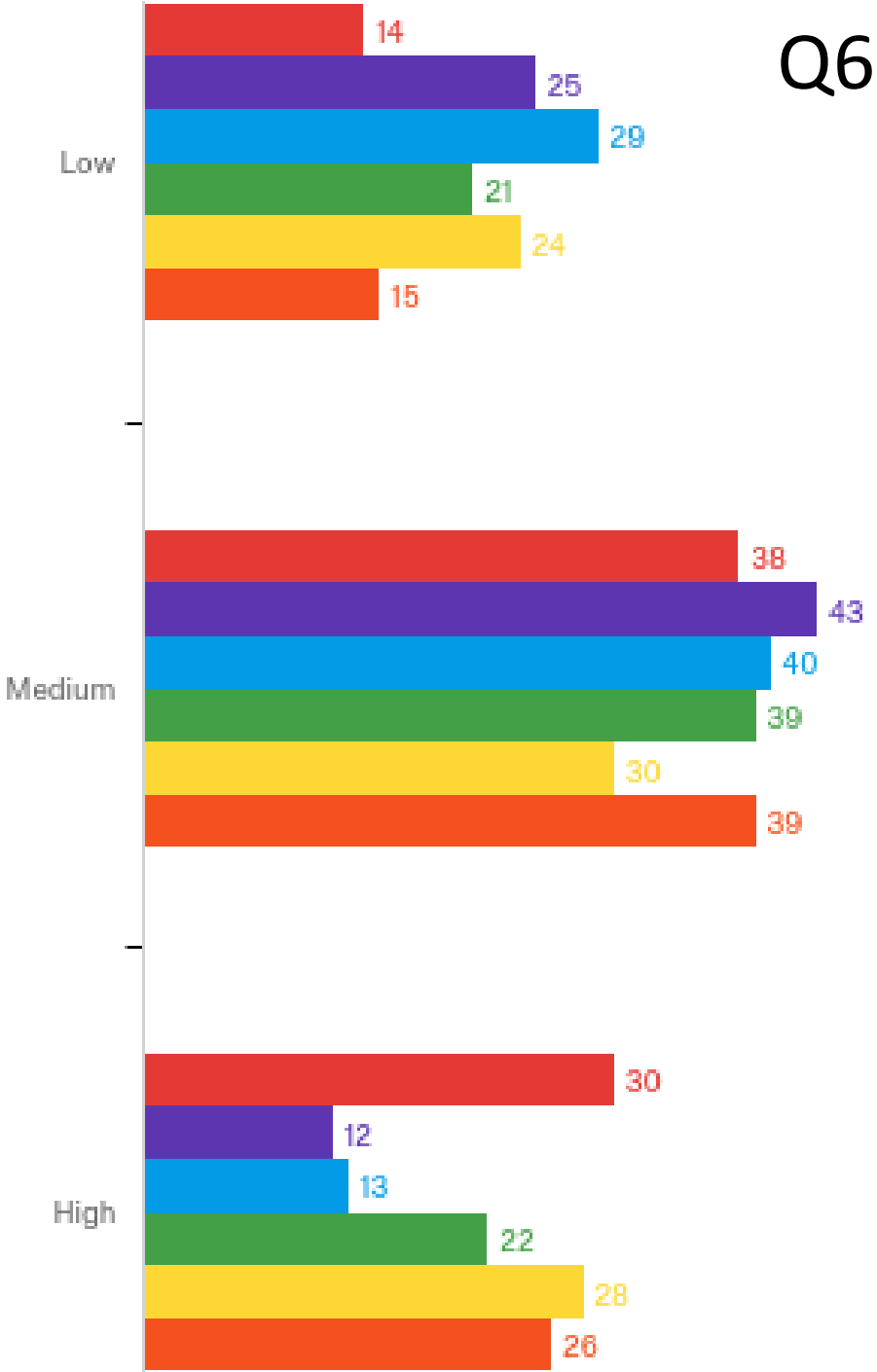


- Geriatric trauma triage criteria (likely available-depends on criteria sele...
- Frailty scoring (not currently captured)
- ED LOS (currently available)
- Time to orthopedic consult (not currently captured)
- Time to medical clearance (not currently captured)
- Regional anesthesia (nerve block) use (not currently captured)
- Regional anesthesia (nerve block) timeliness (not currently captured)
- Time to surgery (currently available)
- Post op delirium screening (not currently captured)

Geriatric trauma triage

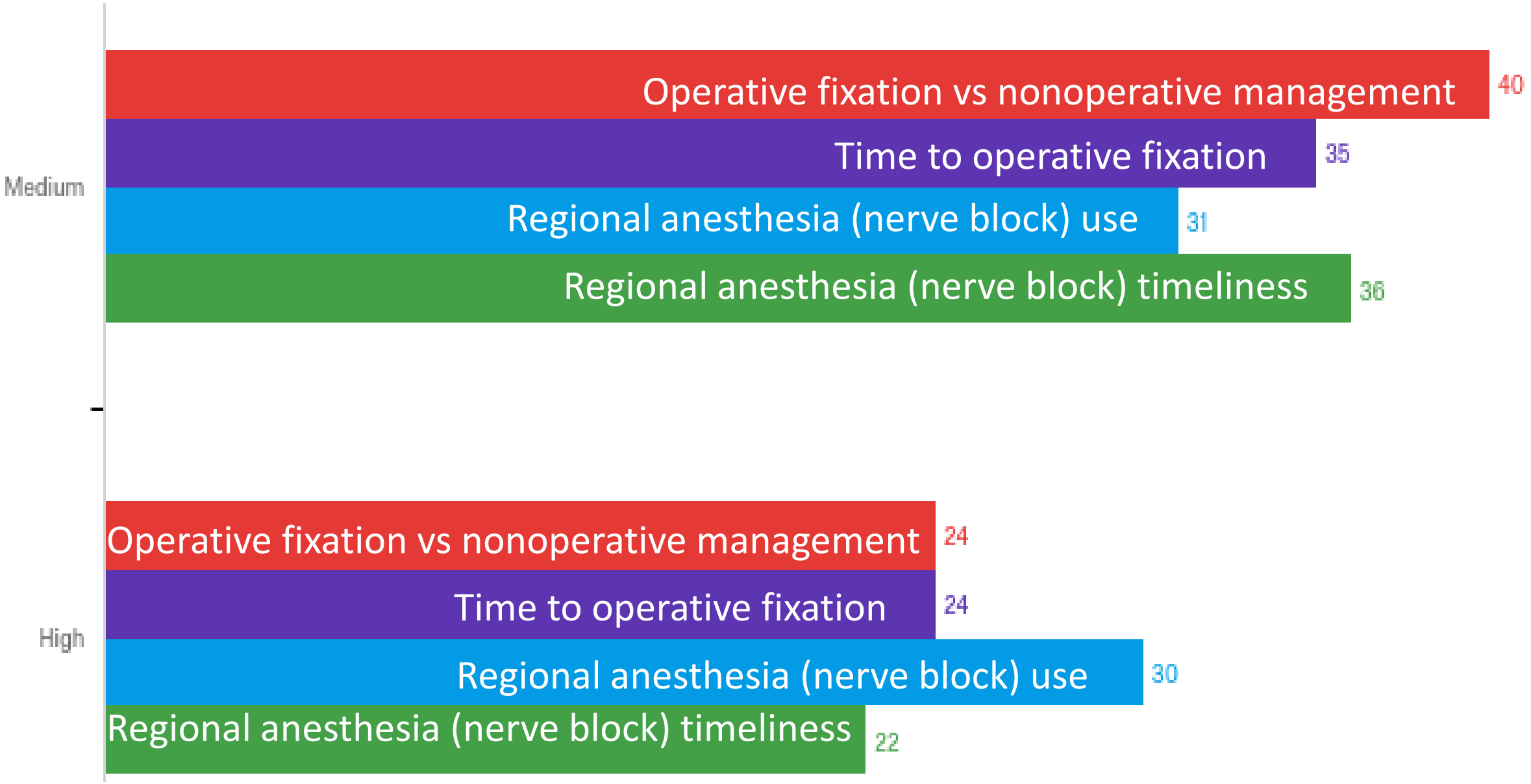
Time to hip fx fixation

Q6 - Traumatic Brain Injury Measure Interest

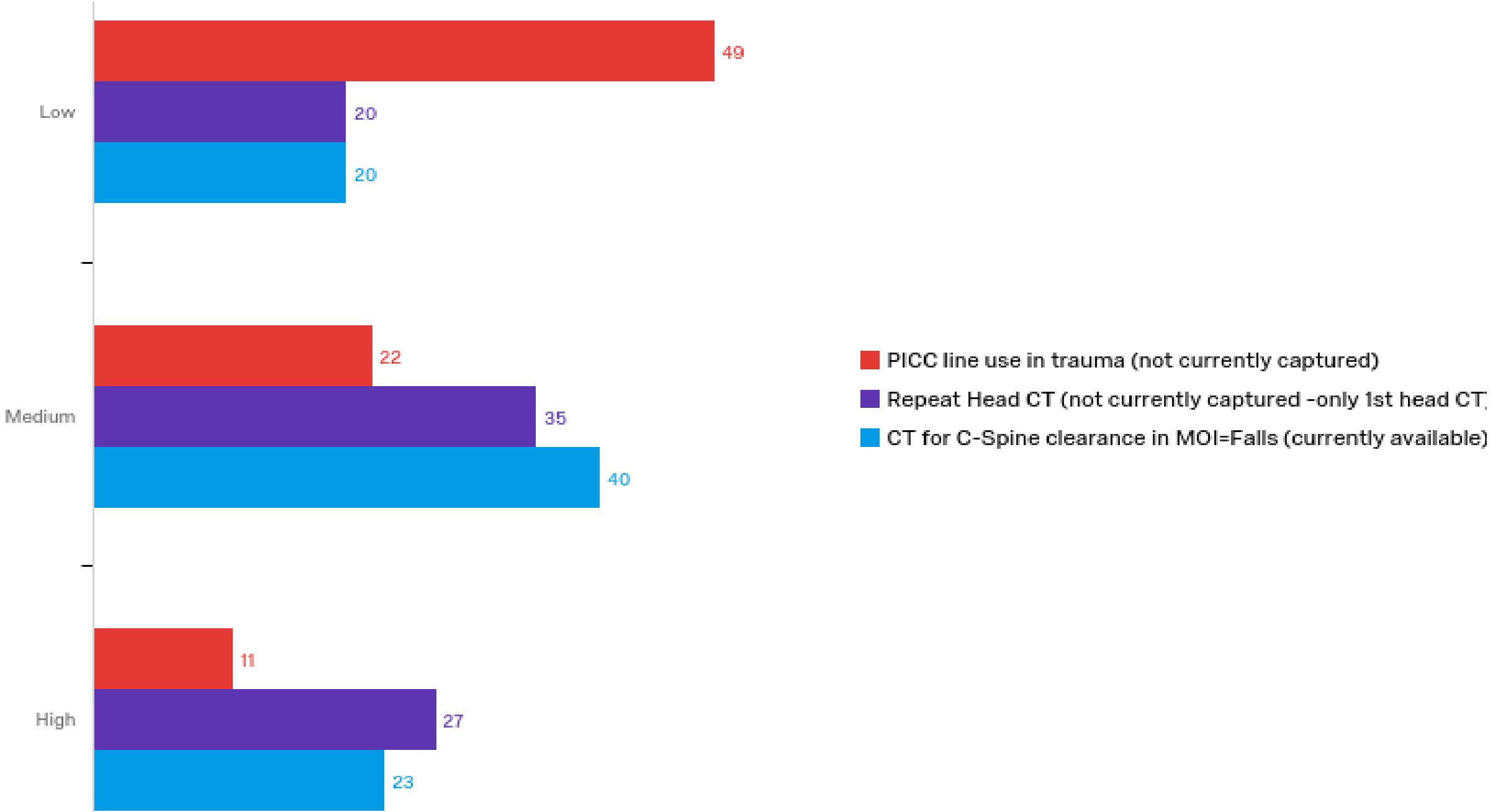


- NOACS vs LMWH in VTE (currently available)
- Beta blocker use (currently available)
- Tracheostomy timing (currently available)
- Time to INR normalization in anticoagulated (not currently captured)
- Prothrombin complex concentrate (PCC) use in anticoagulated (currently avai...
- Activation criteria in anticoagulated (likely available-depends on criteria...

Q7 - Rib Fracture Measure Interest



Q8 - Overuse Measure Interest



Suggestions

✓Make sure measures are evidence based

General Trauma

- Hospital readmissions
- Non surgical admissions with ISS≥10
- Nutrition - severely injuries
- Door to thiamine time in alcoholics
- Acute Stress disorder (ASD) rather than PTSD

Suggestions

Pre-Hospital

- Helicopter transfer necessity

Resuscitation

- Whole blood vs component (several comments)
- TXA timeliness
- Plasmalyte vs NS
- REBOA use

Suggestions

Geriatric Hip Fractures

- “Really like the focus on geriatric factors”
- “While many of these geriatric hip fx measures are interesting I am not interested in making them performance measures unless there is evidence that one modality is superior to another”
- “I have concerns about hip fracture metrics since most are managed by orthopedics not trauma”

Geriatric Trauma Suggestions

- Osteoporosis workup referral (low energy) falls with fxs
- Palliative care consults
- Lactic acid/BE for initial labs for ground level falls
- Standardized lab work up geriatric (ground level falls)
- Pre/post op isolated hip fx fixation transfusion rates
- Geriatric transfusion standards
- Post op placement of comorbidities
- Nursing care initiatives for highly frail patients
- FVC or IS parameters -initial assessment

Suggestions

Traumatic Brain Injury

- Timeliness and appropriateness of reversal of geriatric head bleed by measurement of **time to first appropriate agent** as per 2017 ACC expert consensus
- Vitamin K in warfarin reversal

Overuse

- I am not sure that CT of c-spine in falls is an overuse--

  We have a very elderly population and a relatively high proportion of asymptomatic c-spine fractures in the fall population.

MTQIP
Death Classification Survey

2017 Deaths

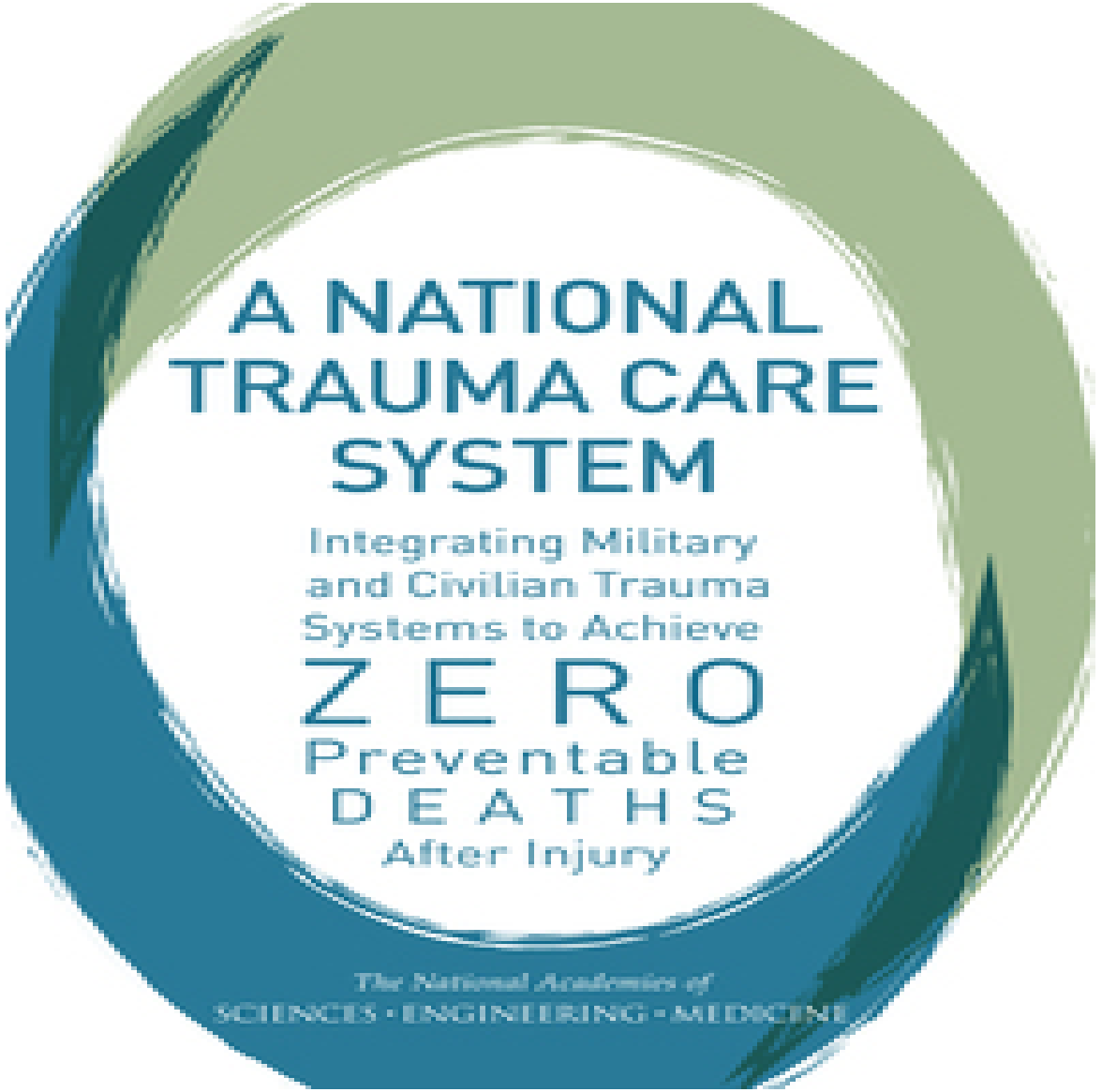
MTQIP 2017 Death Classification Survey

Why?
Informal ACS request for state estimate of death categories

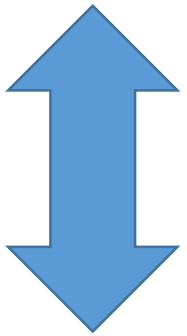
- Mortality with (W) opportunities for improvement (OFI)
- Mortality without (WO) opportunities for improvement (OFI)
- **Unanticipated mortality with (W) opportunities for improvement (OFI)**

Response Rate
31/34 centers = 91%

2016



Military Preventable Deaths



Civilian Unanticipated Mortality

NASEM Trauma Care Report 2016

- Who would benefit the most from a National Trauma System?
- U.S. Military: Approximately 1,000 potentially preventable deaths from combat trauma 2001-2011
- U.S. Civilian Sector: Approximately 20,000 to 30,000 potentially preventable deaths from trauma every year

Berwick, Downey, Cornett
JAMA 2016

Results

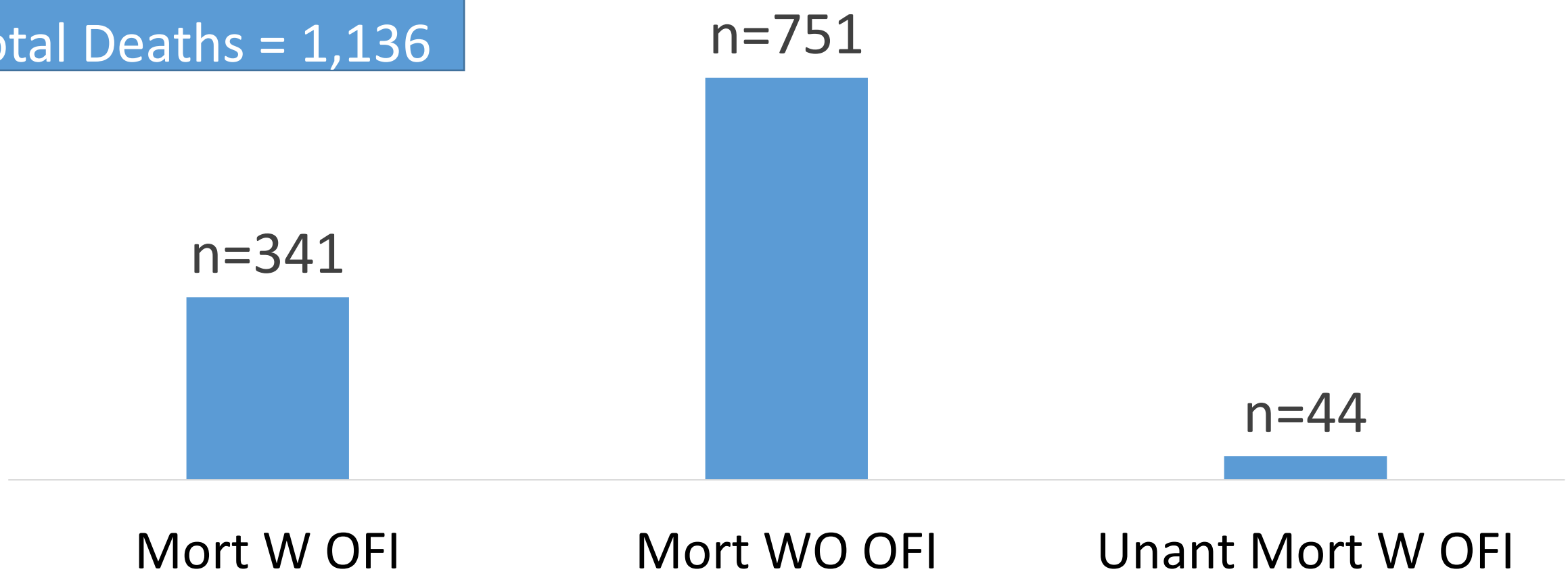
MTQIP
Unanticipated Deaths

- Of 31 Centers
- Total 1136 deaths
- 44 (4%) unanticipated deaths
- Extrapolate to 50 states
- 44 X 50 = 2200 deaths/year

National Trauma Care System
Zero Preventable Deaths

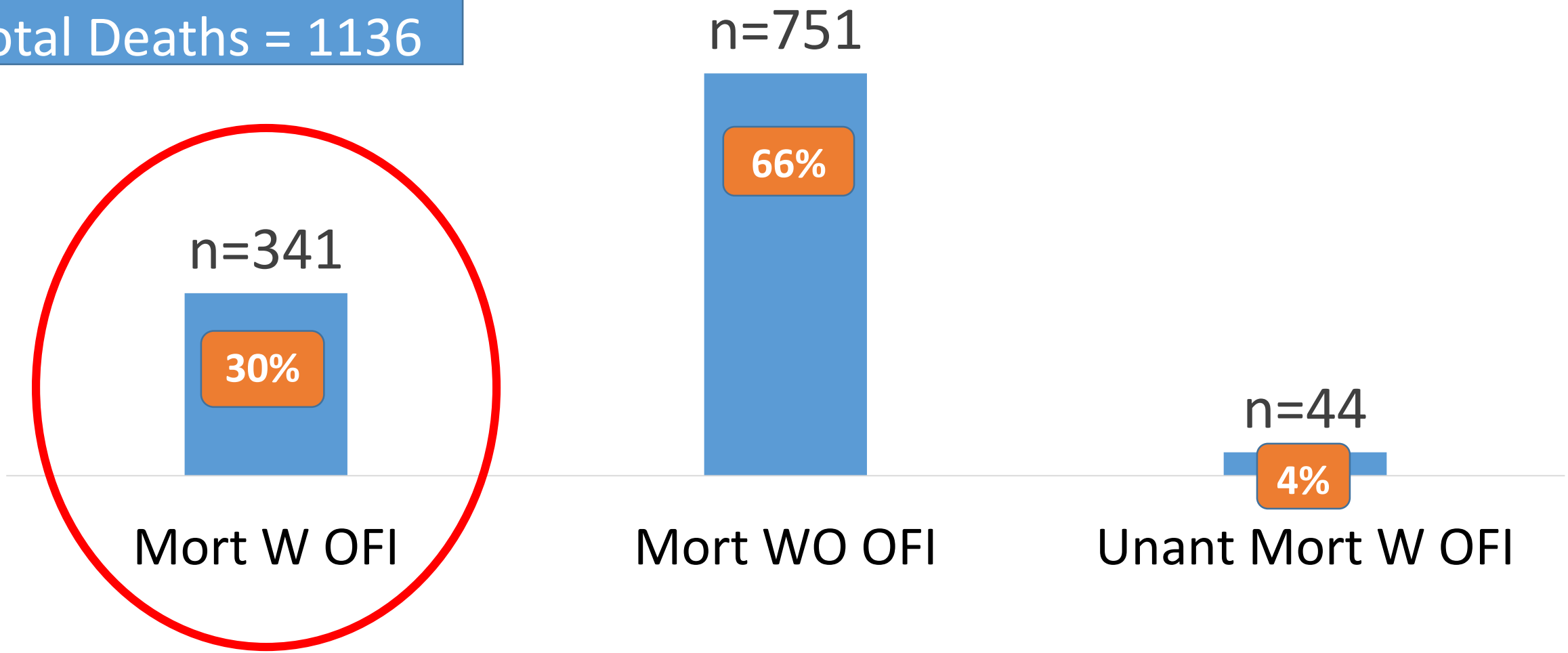
- Estimate 20,000 to 30,000 deaths

31 Centers
Total Deaths = 1,136



Total	**341**	**751**	**44**
Min-Max	1-63	2-91	0-4
Average	11	24	1.4

31 Centers
Total Deaths = 1136

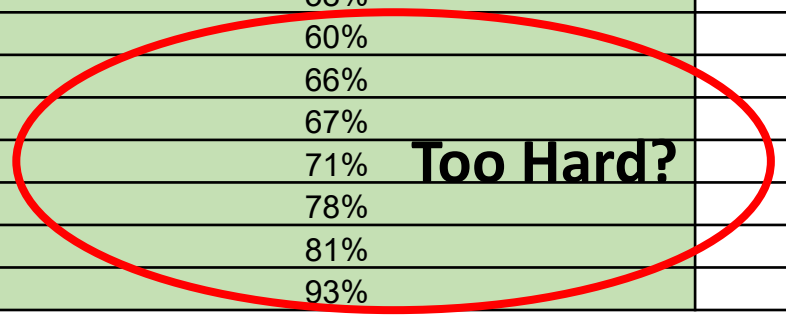


Total	**341**	**751**	**44**
Min-Max	1-63	2-91	0-4
Average	11	24	1.4

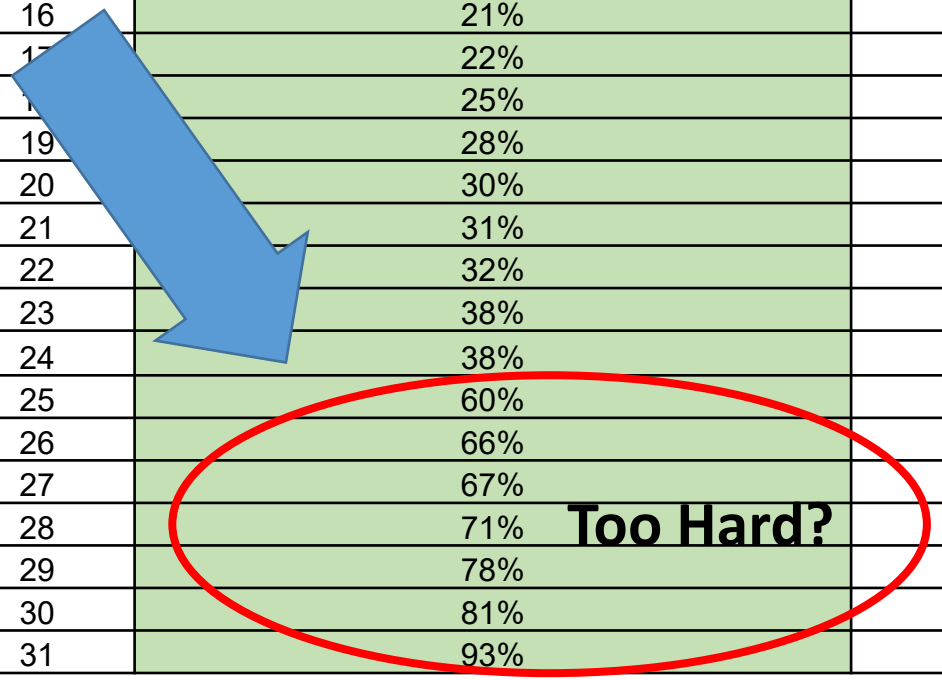
Mortality with opportunities for improvement

- Measure of how hard you are on yourself?
- Interpretation issue?
  - small process measures vs significant errors

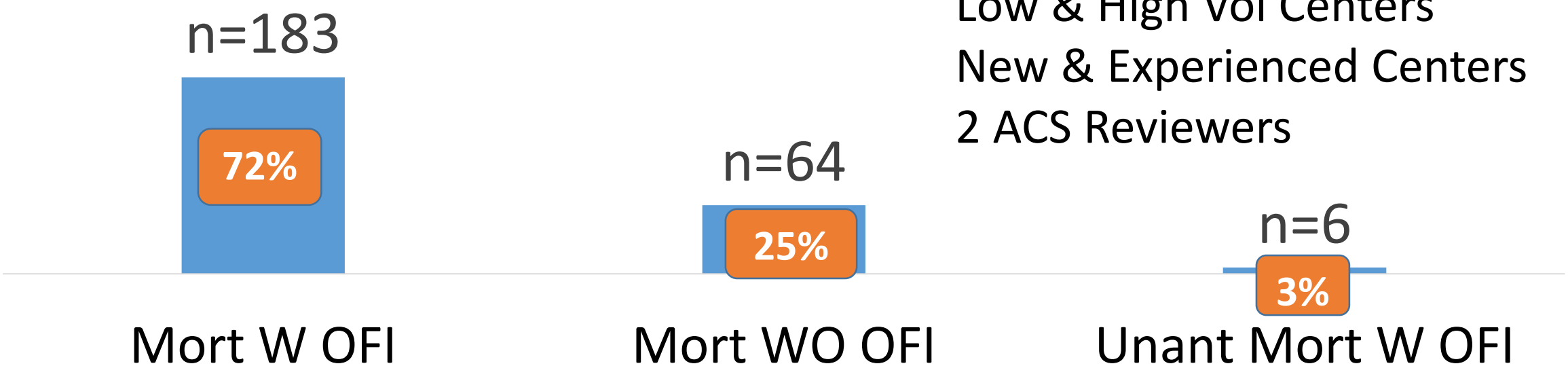
#	Mort W OFI %	Mort WO OFI %	Unant Mor W OFI %
1	4%	96%	0%
2	5%	95%	0%
3	8%	92%	0%
4	10%	85%	5%
5	11%	78%	11%
6	13%	75%	13%
7	13%	81%	6%
8	14%	85%	1%
9	15%	77%	8%
10	15%	85%	0%
11	15%	54%	31%
12	15%	73%	12%
13	16%	80%	4%
14	17%	78%	6%
15	20%	73%	7%
16	21%	68%	11%
17	22%	67%	11%
18	25%	63%	13%
19	28%	70%	2%
20	30%	68%	3%
21	31%	64%	5%
22	32%	53%	16%
23	38%	62%	0%
24	38%	62%	0%
25	60%	40%	0%
26	66%	32%	2%
27	67%	29%	5%
28	71%	26%	3%
29	78%	15%	7%
30	81%	19%	0%
31	93%	7%	0%



#	Mort W OFI %	Mort WO OFI %	Unant Mor W OFI %
1	4%	96%	0%
2	5%	95%	0%
3	8%	92%	0%
4	10%	85%	5%
5	11%	78%	11%
6	13%	75%	13%
7	13%	81%	6%
8	14%	85%	1%
9	15%	77%	8%
10	15%	85%	0%
11	15%	54%	31%
12	15%	73%	12%
13	16%	80%	4%
14	17%	78%	6%
15	20%	73%	7%
16	21%	68%	11%
17	22%	67%	11%
18	25%	63%	13%
19	28%	70%	2%
20	30%	68%	3%
21	31%	64%	5%
22	32%	53%	16%
23	38%	62%	0%
24	38%	62%	0%
25	60%	40%	0%
26	66%	32%	2%
27	67%	29%	5%
28	71%	26%	3%
29	78%	15%	7%
30	81%	19%	0%
31	93%	7%	0%



Only 7 Centers: Mort W OFI > Mort WO OFI
n=253 deaths



Mix of:
Low & High Vol Centers
New & Experienced Centers
2 ACS Reviewers

Total	**341**	**751**	**44**
Min-Max	12-63	2-30	0-2
Average	26	9	0.9

Acute Care Surgery

Mark Hemmila

Conclusion

- Thank you for attending
- Evaluations
  - Fill out and turn in
- Questions?
- See you in June/October

Acute Care Surgery

- Inadequate on-call specialty coverage (2005, ACEP)
- Surgical society response
- Acute care surgery
  - Trauma
  - Surgical Critical Care
  - Emergent General Surgery
- Fellowship (2008)
- Model of care at many hospitals

Medicare - Trauma

Demographics	**Traumatic Injury**	**Congestive Heart Failure**	**Pneumonia**	**Stroke**	**Acute Myocardial Infarction**
Hospitalizations (n)	657,749	692,031	502,071	316,606	313,022
Proportion of Overall Hospitalizations (%)	5.6 ± 0.2	5.9 ± 0.1	4.3 ± 0.1	2.7 ± 0.2	2.7 ± 0.1
Median (IQR) Age	83 (76-88)	81 (74-87)	81 (73-87)	80 (73-87)	78 (71-85)
Male Sex (%)	29.9 ± 0.5	44.8 ± 0.4	44.9 ± 0.3	41.4 ± 0.6	51.1 ± 0.9
Cumulative Annual Payments					
Index Hospitalization ($, *millions*)	1,117 ± 30	713 ± 41	517 ± 29	455 ± 12	604 ± 19
Readmission	316 ± 23	548 ± 45	289 ± 23	151 ± 7	262 ± 26
Post-Acute Care	1,344 ± 63	555 ± 18	439 ± 22	555 ± 20	245 ± 6
Skilled Nursing Facility	860 ± 55	237 ± 11	214 ± 13	238 ± 14	93 ± 4
Inpatient Rehabilitation	230 ± 9	32 ± 2	20 ± 2	193 ± 6	22 ± 1
Part-B Expenses	206 ± 7	250 ± 7	169 ± 8	96 ± 5	110 ± 5
Long-Term Acute Care Facility	49 ± 5	36 ± 2	34 ± 3	28 ± 2	20 ± 1
Total Annual Payments	2,777 ± 100	1,817 ± 91	1,244 ± 70	1,160 ± 29	1,111 ± 46

Acute Care Surgery – Economic Footprint

The Economic Footprint of Acute Care Surgery in the United States

Implications for Systems Development

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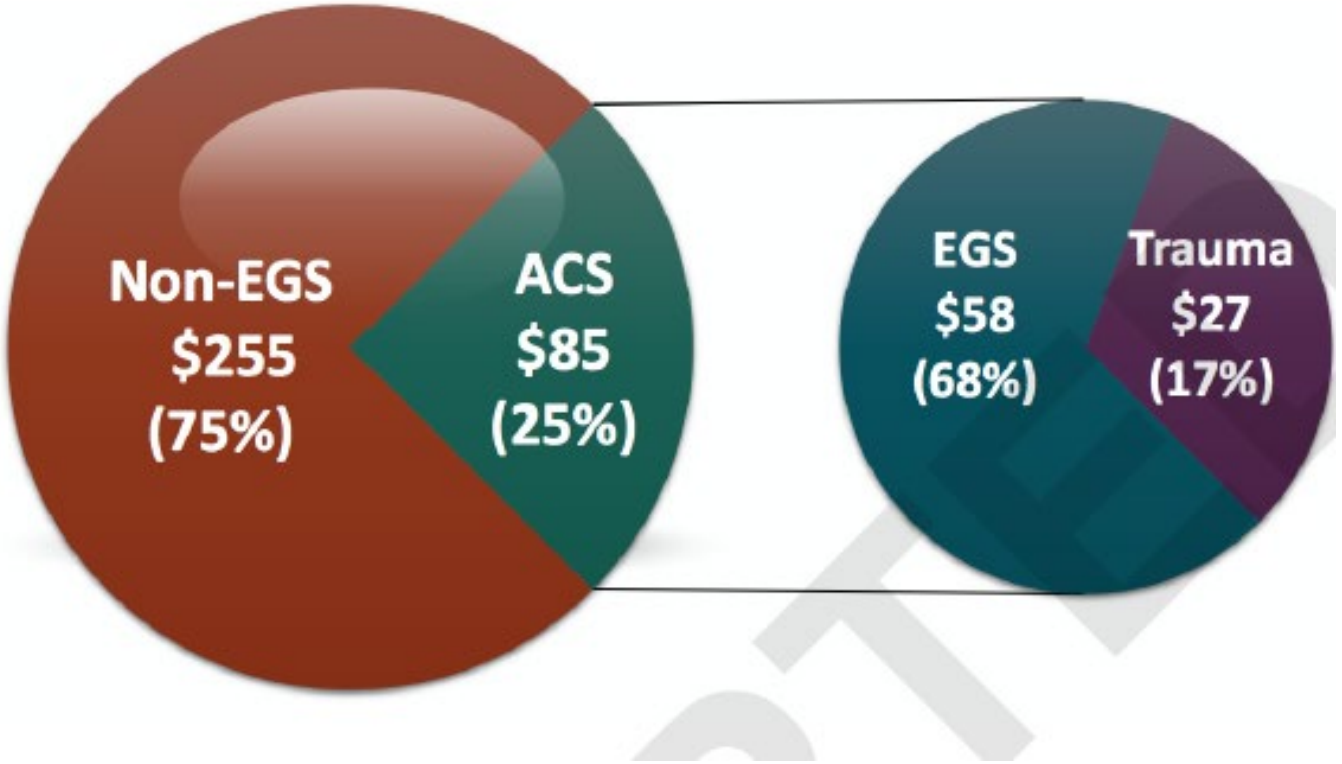
Acute Care Surgery – Economic Footprint

- National Inpatient Sample
- ICD-9
  - Trauma
  - 16 Emergent General Surgery Conditions
- 29 million patients
  - 20% ACS diagnosis
  - 25% of US inpatient costs
  - $86 Billion
- Inpatient operative procedure
  - 27% have an ACS diagnosis

Acute Care Surgery – Economic Footprint



Takeaway

- Prevalence - high
- Expense - high
- Problems - many

- Small iterative savings/improvements have potential for large impact overall

Projects and Preliminary Results

- Emergent General Surgery Data
  - Michigan Medicine
  - SCOAP
- Sharing Data Across CQI’s

Emergent General Surgery Data

- Michigan Medicine
- 2014 - 2018
- All touches of Acute Care Surgery Service
- 2,700 cases/year
- 1,200 cases/year get an operation
- Operation > MSQC case > MSQC data entry
  - Core
  - Oversampled
- Extra data
  - Appendicitis
  - Gall bladder disease
  - Operative
  - Non-operative

Emergent General Surgery Data

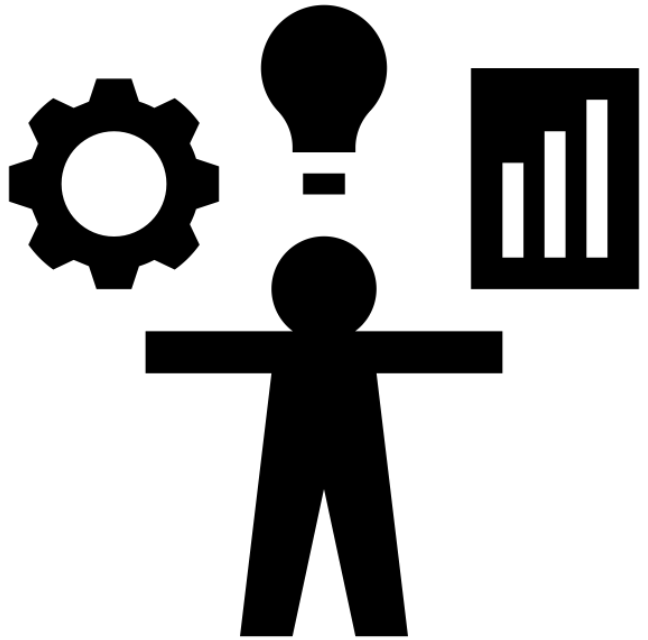
- Michigan Medicine
- 7/1/2018
- Qualtrics database
- All touches of Acute Care Surgery Service
- Extra Data
  - Appendicitis
  - Gall bladder disease
  - SBO
  - Ventral Hernia
  - Interventional Radiology Procedure
- SCOAP - SBO

Sharing of Data Across CQI

- ASPIRE
- Michigan Medicine Data for isolated hip fracture
- Initiating MTQIP and ASPIRE amendments
- Isolated hip fracture at MM
  - MRN and DOS +/- 1 day
  - 92% initial match rate
  - Eliminate patients with no operation or femur
  - 99.4% match

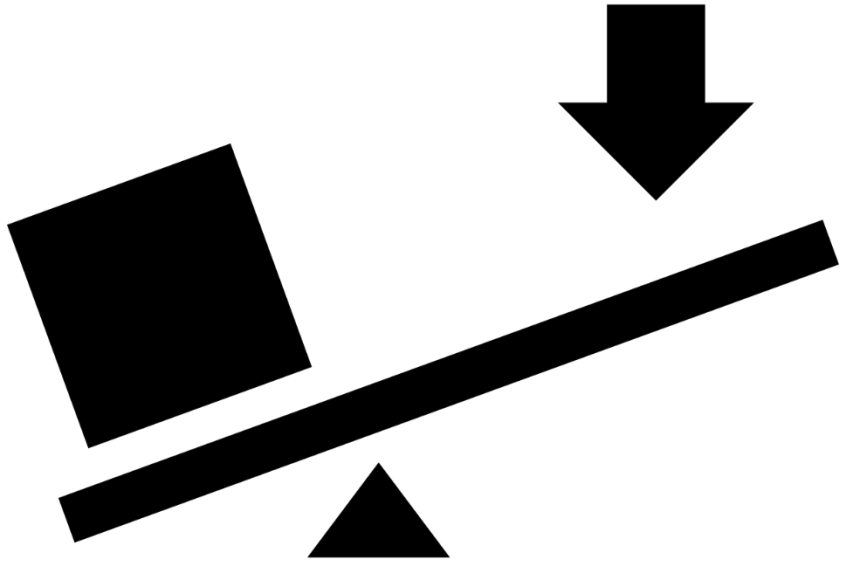
Future

- Impact, impact, impact
- Anticipate data needs
- 80/20 sweet spot
- Share across CQI’s
  - Data
  - Projects
- Broaden information reach



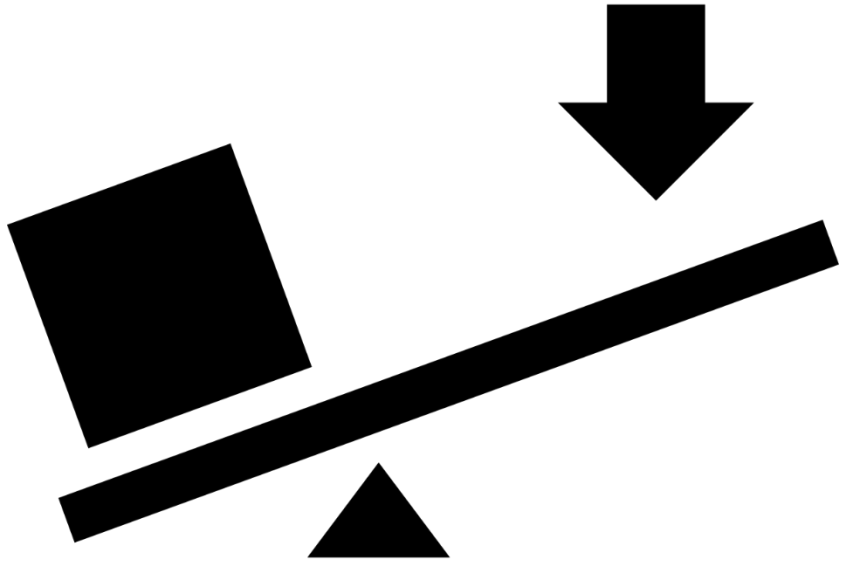
Summarize

- Emergent General Surgery
  - 4 hospitals
  - Select conditions (4-5)
  - Operative and non-op
- MSQC
- MTQIP
- Share data



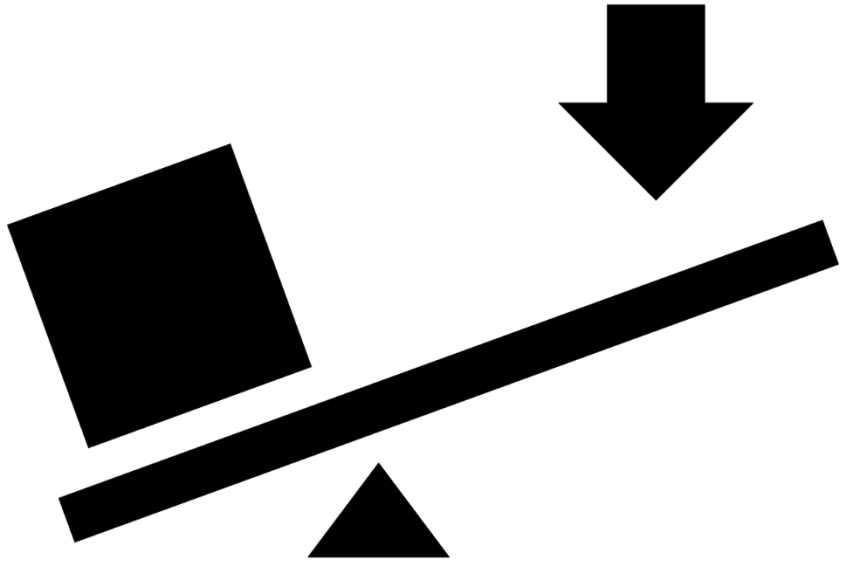
Update

- Targets
  - Centers identified
  - Sign documents
  - Onboard, train
  - Start data collection 7/19
- Meet
  - Review data collection
  - Adjust program
  - Set future agenda



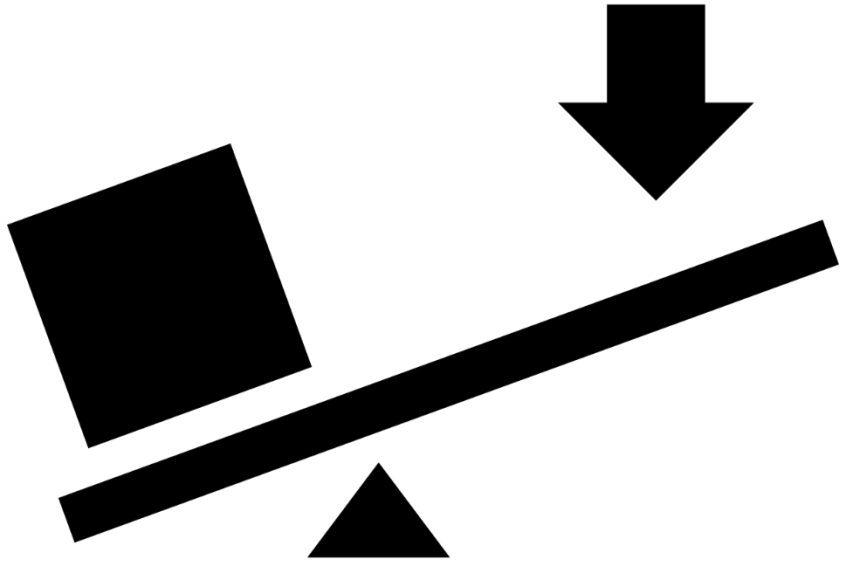
Center Criteria

- MSQC and MTQIP
- Acute Care Surgery Model
  - Case capture
  - Buy in
- Ability to access funding for data collection
- EPIC +/-
- ASPIRE +/-



Logistics

- MTQIP documents
  - Participation agreement
  - Exhibit A (expectations)
  - Exhibit B (existing BAA)
  - Amendment 1 (share ASPIRE)
  - Amendment 2 (share MSQC)
- Data Definitions Manual
- Training
- Oversample cases
- Qualtrics



Questions