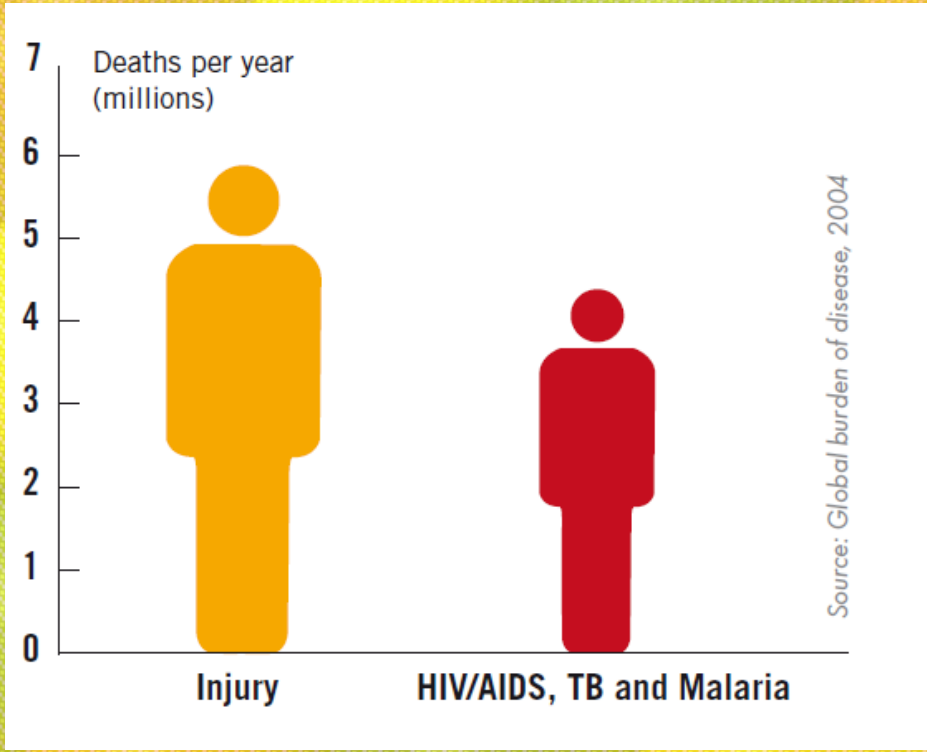
Trauma system research; building evidence, but lacking quality indicators.



Stefano Di Bartolomeo, University Hospital – Udine, Italy / Regional Agency for Health – Bologna, Italy / NAAF- Norway

Summary

1. Brief definition of quality indicators (QI)
2. Brief review of QIs in trauma care
3. Specific aspects of Trauma-System QIs

Definition 1

Quality indicator

An instrument to measure quality, i.e. “the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge.” (I.O.M., USA)

Definition 2

A QI is a performance measure that compares actual care against ideal criteria (A.H.C.R.Q., USA)

Quality is not absolute and 100% objective but somewhat relative and/or subjective

Managers, clinicians, politicians, patients may have a different idea of quality and therefore require different indicators

For example:

For Quality =

- managers > cheapness or cost-effectiveness
- clinicians > efficacy
- politicians > citizens' satisfaction
- …

Donabedian's classification of QIs:

- Structure
- Process
- Outcome

REQUISITES OF QIS

1) 'RELIABILITY' or 'PRECISION'

= low variability (es. intra-rater inter-rater)

2) 'VALIDITY (content, criterion, construct) or 'SCIENTIFIC ACCEPTABILITY' or 'SOUNDNESS'

= quantitative evidence in support

3) 'FEASIBILITY' or 'AFFORDABILITY'

= the underlying data must be available with reasonable facility

4) 'USABILITY', 'IMPORTANCE', 'FACE VALIDITY'

= recognized or approved by enough people

• *Foster real quality improvement. No perverse effect. The indicator should be robust to possible provider manipulation.*

Agency for Healthcare Research and Quality

REVIEW ARTICLE

Quality Indicators for Evaluating Trauma Care

A Scoping Review

Henry Thomas Stelfox, MD, PhD; Barbara Bobranska-Artiuch, MD; Avery Nathens, MD, PhD; Sharon E. Straus, MD, MSc

Arch Surg. 2010;145(3):286-295

Objectives: To systematically review the literature on quality indicators (QIs) for evaluating trauma care, identify QIs, map their definitions, and examine the evidence base in support of the QIs.

Conclusions:

- There are many QIs (1572) described in literature
- Adult acute trauma care is well-covered while there is poor coverage of pediatric and post-acute care
- The validity (scientific soundness, …), of these QIs is weak

Ten most frequently published QIs (suggested criterion for more in-depth QI evaluation)

Table 6. Candidate Quality Indicators (QIs) for Systematic Review

QI	Types of Original Research Articles
Peer review of trauma deaths to evaluate quality of care and determine whether the death was potentially preventable	19 Case series[13,19,34,39,50,69,76,79,85,87,99,115,119-121,124,188,189,200]; 18 cohort studies[10,18,37,49,62,86,109,113,122,140,145,149,151,178,187,194,196,207]; 3 before-and-after case series[51,118,166]; 2 nonrandomized controlled trials[16,205]; and 1 cross-sectional study[17]
Hospital mortality[a]	17 Cohort studies[7,43,49,52,63,83,86,88,105,128,145,149,161,191,192,194,204]; 9 case series[42,55,77,94,126,129,176,184,216]; 4 before-and-after case series[102,130,157,158]; 3 nonrandomized controlled studies[103,203,205]; 2 cross-sectional studies[82,168]; and 1 case-control study[9]
Complications during hospital stay[b]	9 Cohort studies[7,8,53,62,88,107,128,161,199]; 5 case series[12,34,50,108,125]; 4 cross-sectional studies[75,82,101,148]; 2 before-and-after case series[56,91]; 1 case-control study[9]; and 1 consensus method[177]
Patient treated at the scene longer than X min (range, 10-30 min)	10 Cohort studies[7,8,18,65,66,71,88,107,128,161]; 2 before-and-after case series[74,171]; 2 case series[12,129]; and 1 consensus method[154]
Glasgow Coma Scale score <X (range, 9-14) and no CT scan of the head within X h (range, 1-4 h) of arrival	5 Cohort studies[7,10,66,128,199]; 3 before-and-after case series[51,74,158]; 3 case series[42,50,208]; 1 case-control study[9]; 1 cross-sectional study[156]; and 1 consensus method[177]
Time from patient hospital arrival to emergency surgical treatment (range, <30 min to <4 h)	5 Cohort studies[18,50,128,199,204]; 3 before-and-after case series[73,130,158]; 2 case series[42,208]; 1 nonrandomized controlled trial[93]; 1 case-control study[9]; 1 cross-sectional survey[156]; and 1 consensus method[177]
Unscheduled surgical treatment within X h (range, 24-48 h) of initial procedure	3 Cohort studies[7,107,128]; 3 before-and-after case series[74,157,158]; 3 case series[42,50,129]; 1 case-control study[9]; and 1 consensus method[177]
Missed injuries, ie, injuries diagnosed/documented X h (range, 24 h to discharge) after admission	5 Cohort studies[7,107,128,161,169]; 3 case series[34,50,152]; 1 before-and-after case series[158]; and 1 consensus method[177]
Glasgow Coma Scale score <X (range, 8-10) and airway not secured within X (range, <5 min to before patient leaves the ED)	3 Cohort studies[8,128,199]; 3 before-and-after case series[51,74,158]; 1 case-control study[9]; 1 case series[42]; and 1 consensus method[177]
Length of ED stay >X h (range, 2-8 h)	3 Cohort studies[7,65,161]; 3 before-and-after case series[73,74,166]; and 2 case series[42,208]

Evidence for quality indicators to evaluate adult trauma care: A systematic review*

Henry T. Stelfox, MD, PhD, FRCPC; Sharon E. Straus, MD, MSc, FRCPC; Avery Nathens, MD, PhD, FRCSC; Barbara Bobranska-Artiuch, MD

Crit Care Med 2011 Vol. 39, No. 4

Objective: Multiple quality indicators are available to evaluate adult trauma care, but their characteristics and outcomes have not been systematically compared. We sought to systematically review the evidence about the reliability, validity, and implementation of quality indicators for evaluating trauma care.

Conclusions

- The assessment of the reliability, validity or the impact of its implementation has been undertaken for only 115/1572 QIs
- One QI has evidence of reliability, validity, and improved outcomes after implementation > *peer-reviewed preventable death*.
- Six QIs (next slide) have supporting evidence for two measurement domain (but not both validity and reliability)
- No QI about posthospital care or secondary injury prevention has ever been assessed

The six Qis with evidence in two domains

1) Scene time;

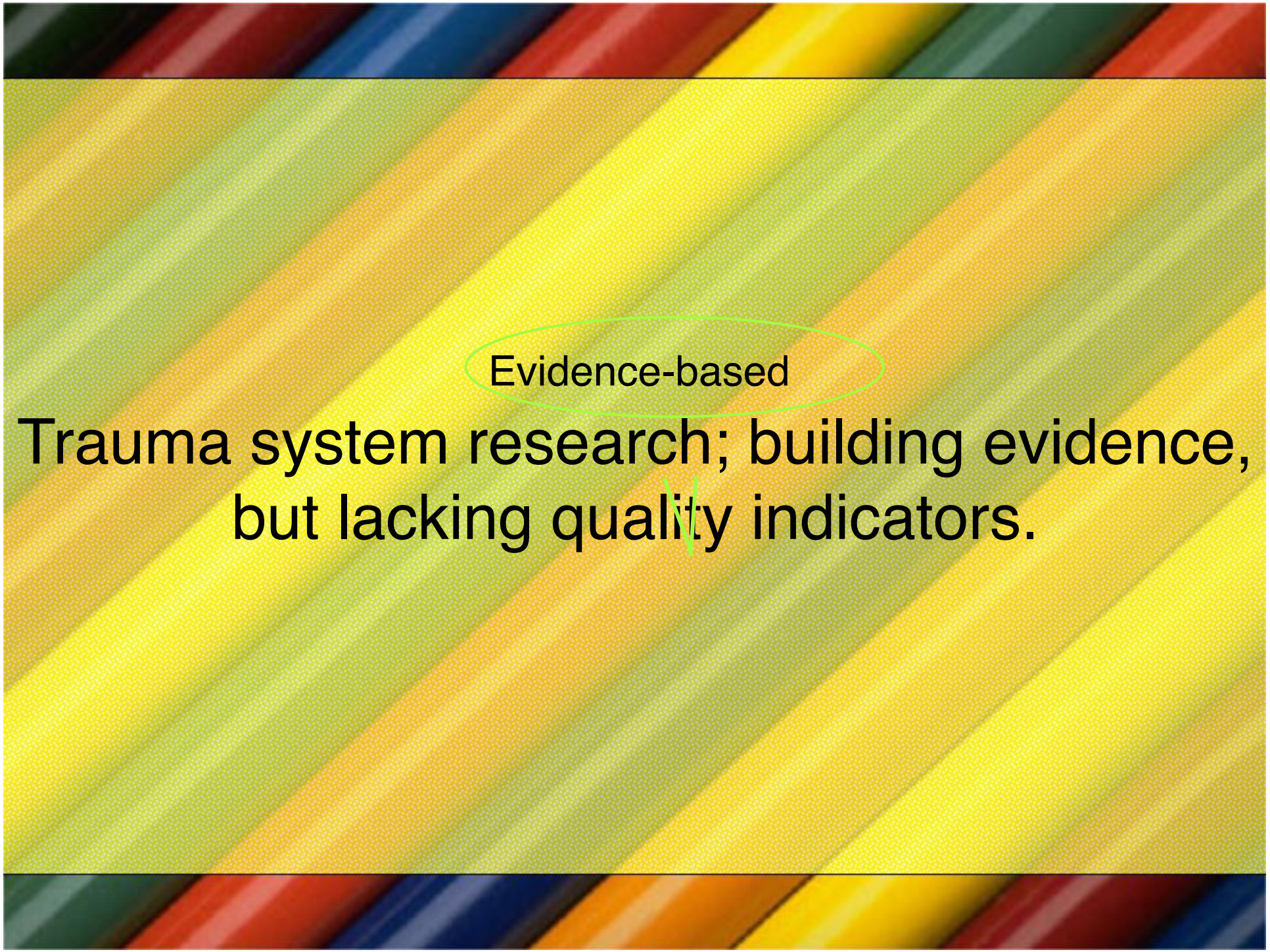
2) Time to emergency laparotomy;

3) Unplanned return to the operating room within 48 hrs of initial procedure;

4) Complications;

5) Reintubation within 48 hrs of extubation;

6) Missed injuries;


Evidence-based
Trauma system research; building evidence, but lacking quality indicators.

The original sin of trauma care

Injury, Int. J. Care Injured 42 (2011) 117–118

Contents lists available at ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

Editorial

Trauma research: An opportunity and a challenge

However, the reality is that: (a) basic disease processes, such as secondary brain injury and coagulopathy, are incompletely understood; (b) there is wide variation in care across the UK[11] and (c) many common interventions are practiced on the basis of low quality evidence.[17]

Possible solutions:

Increase the evidence through more/better research

Use the available evidence

Purpose-driven indicators, i.e. consider common practice or desired processes of care as evidence

Evaluate at least face validity through expert consensus

Use the available evidence.

Effects of tranexamic acid on death, vascular occlusive events, and blood transfusion in trauma patients with significant haemorrhage (CRASH-2): a randomised, placebo-controlled trial

*CRASH-2 trial collaborators**

Summary

Background Tranexamic acid can reduce bleeding in patients undergoing elective surgery. We assessed the effects of early administration of a short course of tranexamic acid on death, vascular occlusive events, and the receipt of blood transfusion in trauma patients.

Lancet 2010; 376: 23–32
Published Online
June 15, 2010

4) Importance +

4b Fosters real quality improvement/no perversion +

But let’s stick to Trauma System in a stricter sense


The Journal of TRAUMA® Injury, Infection
Assessing Effectiveness of a Mature Trauma Syste
Association of Trauma Center Presence with Low
Mortality Rate
Linda Papa, MD, Barbara Langland-Orban, PhD, Celleste Kallenborn, RN, Jos
Lawrence Lottenberg, MD, Brian Celso, PhD, Rodney Durham, MD, and Lev
Increased Survival Am
The Impact of a National Trauma
Kobi Peleg, PhD, MPH; Limor Aharonson-Dani
Avraham Rivkind, MD; Valentina Boyko, MSc
The Journal of TRAUMA® Injury, Infection,
Do Trauma Centers Improve Functional Outcomes: A
Trauma Databank Analysis?
Ram Nirula, MD, MPH, and Karen Brasel, MD, MPH
The Journal of TRAUMA
ORIGINAL ARTICLES
The Effect of Trauma Center Designation and Trauma Volume on Outcome in Specific Severe Injuries
Demetrios Demetriades, MD, PhD, Mathew Martin, MD, Ali Salim, MD, Pe
Carlos Brown, MD, and Linda Chan, PhD
Objective: The objective of this study was to investigate the effect of American College of Surgeons (ACS) trauma center designation and trauma volume on outcome in patients with specific severe injuries.
Background: Trauma centers are designated by the ACS into different levels on the basis of resources, trauma volume, and educational and research commitment. The criteria for trauma center
trauma admissions d
centers. These fi
planning of tr
level of a
The American Journal of Surgery
The American Journal of Surgery 187 (2004) 7–13
Scientific paper
The cost of trauma center readiness
Paul A. Taheri, M.D., M.B.A. a,*, David A. Butz, Ph.D. a, Larry Lottenberg, M.D. b, Art Clawson, Ph.D. c, Lewis M. Flint, M.D. d
aDepartment of Surgery, Division of Trauma Burn and Emergency Surgery, University of Michigan Health System, 1c421 University Hospital, Box 0033, Ann Arbor, MI 48109-0033, USA
bMemorial Hospital, Hollywood, FL, USA
cFlorida State University, Tallahasse, FL, USA
dUniversity of South Florida, Division of Trauma, Tampa, FL, USA
Manuscript received January 7, 2003; revised manuscript June 1, 2003
Excerpta Medica
Relative Importance of Designation and Accre
Trauma Centers during Evolution of a Regional
Trauma System
Richard Simons, MB, BChir, Sharon Kasic, CCHRA, Andrew Kirkpatrick, MD, Les Vertesi, MD, Terry Phang, MD, and Leanne Appleton, RN, MSN
Notebook
rauma centers: Novice to expert
thor: Patricia Southard, RN, MN, JD, Portland, Oregon

Evidence for Trauma Systems

SPECIAL ARTICLE

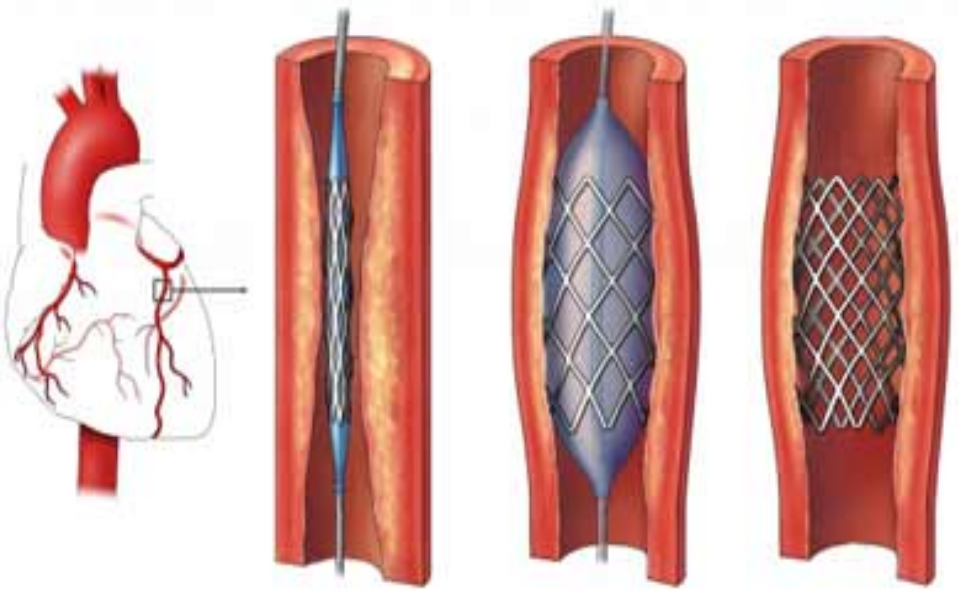
A National Evaluation of the Effect of Trauma-Center Care on Mortality

Ellen J. MacKenzie, Ph.D., Frederick P. Rivara, M.D., M.P.H., Gregory J. Jurkovich, M.D., Avery B. Nathens, M.D., Ph.D., Katherine P. Frey, M.P.H., Brian L. Egleston, M.P.P., David S. Salkever, Ph.D., and Daniel O. Scharfstein, Sc.D.

ABSTRACT

Table 4. Adjusted Case Fatality Rates and Relative Risks of Death after Treatment in a Trauma Center as Compared with Treatment in a Non–Trauma Center.*

Variable	Weighted No. of Patients	Death in Hospital	Death within 30 Days after Injury	Death within 90 Days after Injury	Death within 365 Days after Injury
Overall population	15,009				
Trauma center (%)		7.6	7.6	8.7	10.4
Non–trauma center (%)		9.5	10.0	11.4	13.8
Relative risk (95% CI)		0.80 (0.66–0.98)	0.76 (0.58–1.00)	0.77 (0.60–0.98)	0.75 (0.60–0.95)



Comparison with the two recent milestones in cardiac care: fibrinolysis and angioplasty/stenting

1) Fibrinolysis vs. prev. therapy

Source: Fibrinolytic Therapy Trialists' Collaborative Group. Indications for fibrinolytic therapy[..] Lancet. 1994 Feb 5;343(8893):311-22.

30 fewer deaths every 1000 patients. ⟶ OR = 0.79 (approximately)

2) Angioplasty/stentin

Articles

Primary angioplasty versus intravenous thrombolytic therapy for acute myocardial infarction: a quantitative review of 23 randomised trials

Ellen C Keeley, Judith A Boura, Cindy L Grines

THE LANCET • Vol 361 • January 4, 2003

Mortality from 9% to 7% ⟶ OR = 0.73

Possible TS QI

Percentage of the national population covered by a formal Trauma System

1) Reliability to be formally tested but likely ++

2) Scientific Soundness ++

3) Feasibility ++

4) Importance ++

4b Fosters real quality improvement/no perversion +

Contents lists available at ScienceDirect

Injury

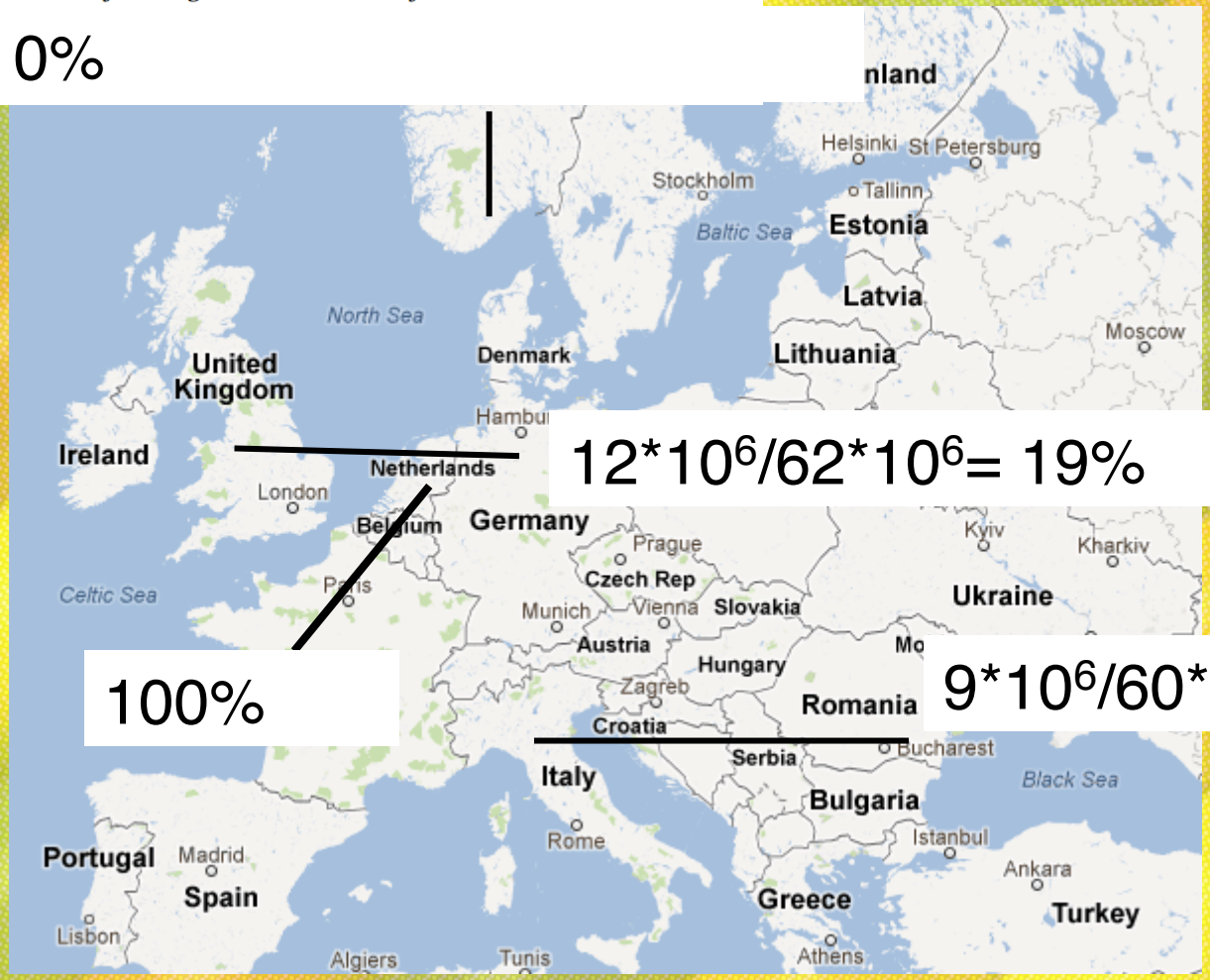
journal homepage: www.elsevier.com/locate/injury

Review

Trauma systems and early management of severe injuries in Scandinavia: Review of the current s

Thomas Kristianser
Andreas Reite[b], Ter

0%

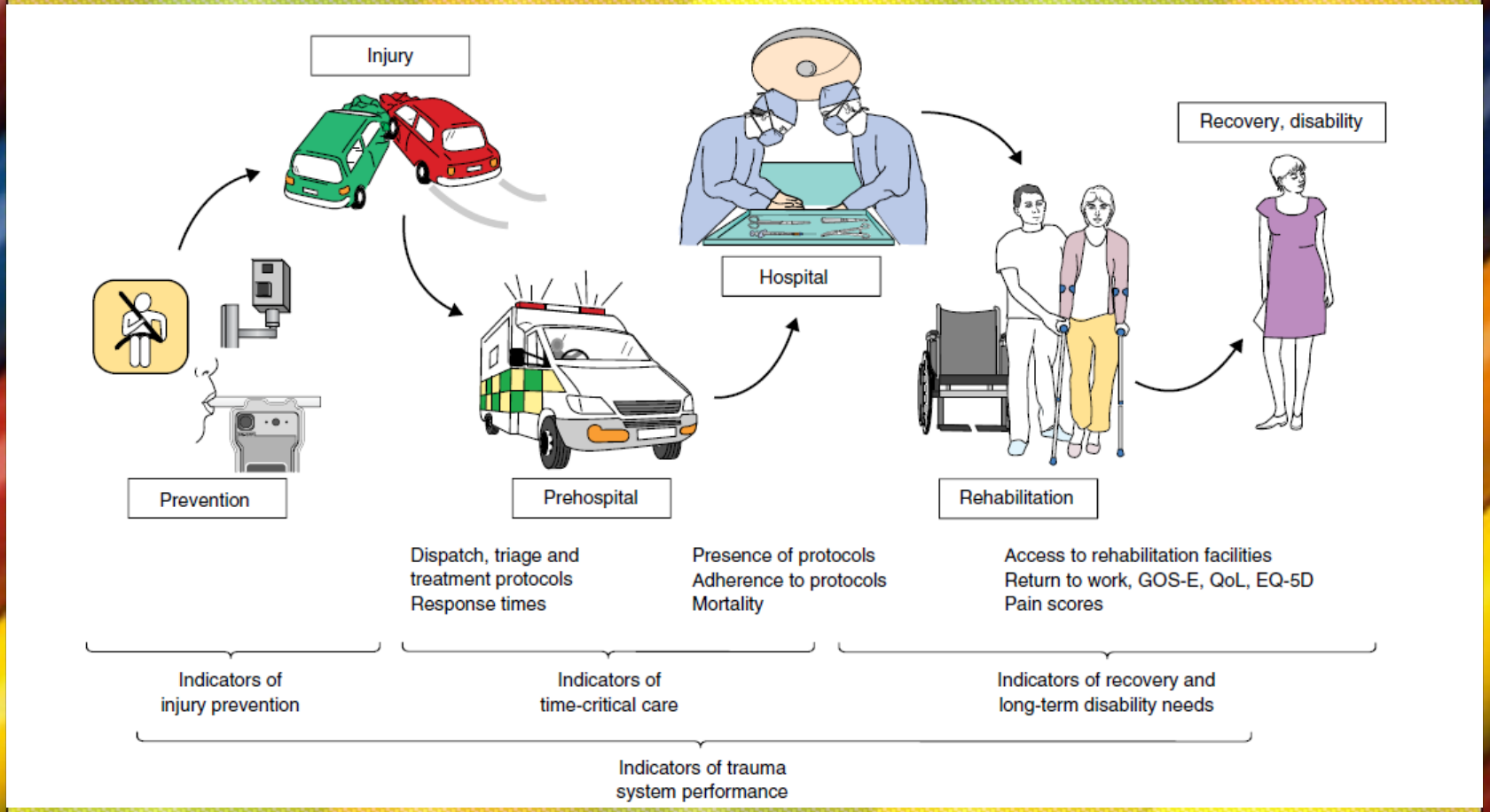


$12*10^6/62*10^6= 19\%$

100%

$9*10^6/60*10^6= 15\%$

Trauma Centers are only a component of the Trauma System 'packet'



It is correct to measure also the quality of its single components, but, if we want to measure the quality of the whole 'packet', then we must be very circumspect.

Geographic distribution of severely injured patients: Implications for trauma system development

David J. Ciesla, MD, Etienne E. Pracht, PhD, John Y. Cha, MD, *and* **Barbara Langland-Orban, PhD,**
Tampa, Florida

BACKGROUND: Despite decades of trauma system development, many severely injured patients fail to reach a trauma center for definitive care. The purpose of this study was to define the regions served by Florida's designated trauma centers and define the geographic distribution of severely injured patients who do not access the state's trauma system.

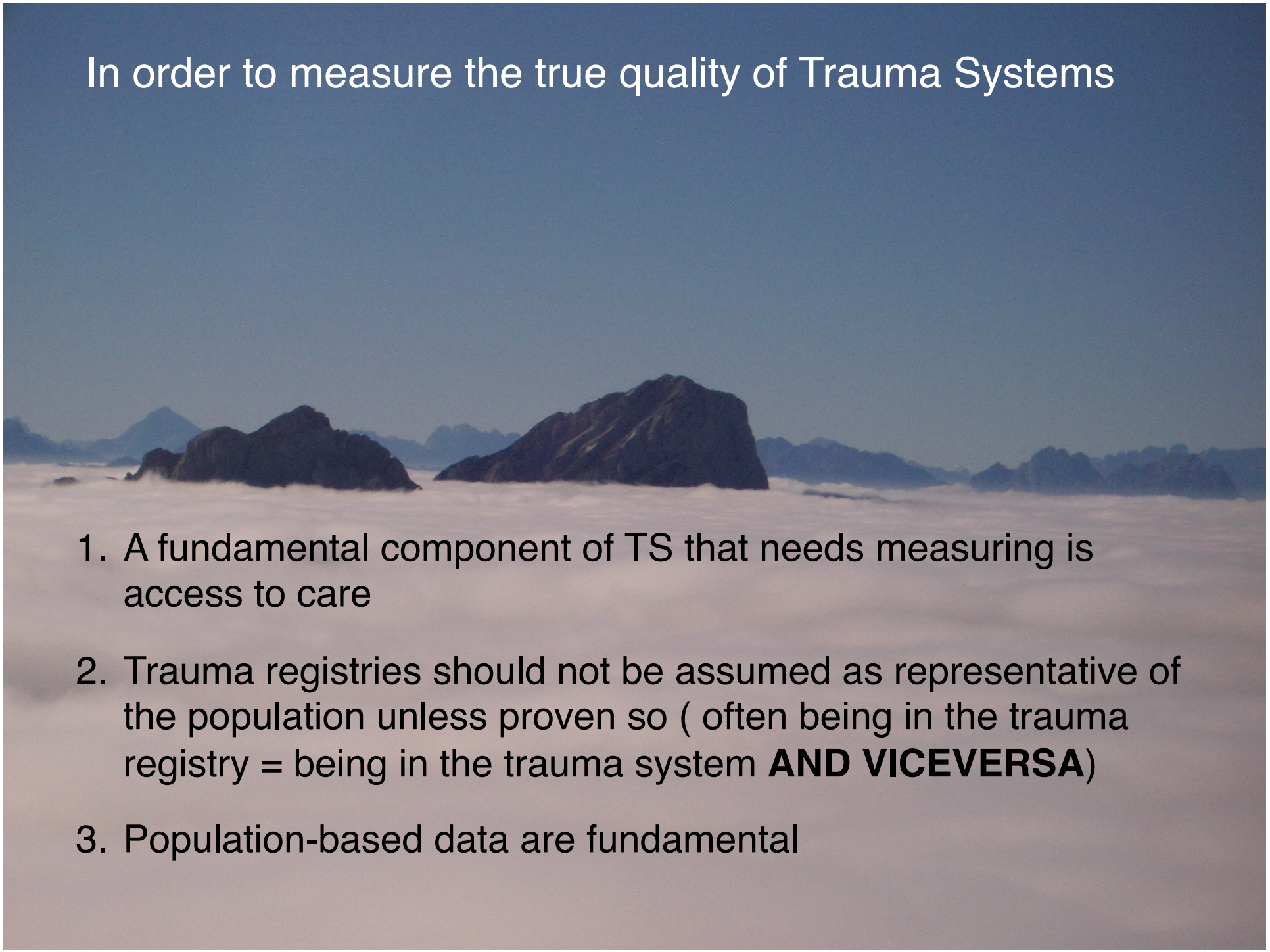
METHODS: Severely injured patients discharged from Florida hospitals were identified using the 2009 Florida Agency for Health Care Administration database. The home zip codes of patients discharged from trauma and nontrauma center hospitals were used as a surrogate for injury location and plotted on a map. A radial distance containing 75% of trauma center discharges defined trauma center catchment area.

RESULTS: Only 52% of severely injured patients were discharged from trauma centers. The catchment areas varied from 204 square miles to 12,682 square miles and together encompassed 92% state's area. Although 93% of patients lived within a trauma center catchment area, the proportion treated at a trauma center in each catchment area varied from 13% to 58%. Mapping of patient residences identified regions of limited access to the trauma system despite proximity to trauma centers.

CONCLUSIONS: The distribution of severely injured patients who do not reach trauma centers presents an opportunity for trauma system improvement. Those in proximity to trauma centers may benefit from improved and secondary triage guidelines and interfacility transfer agreements, whereas those distant from trauma centers may suggest a need for additional trauma system resources. (*J Trauma.* 2012;XX: 000–000. Copyright © 2012 by Lippincott Williams & Wilkins)

LEVEL OF EVIDENCE: II, epidemiological study.

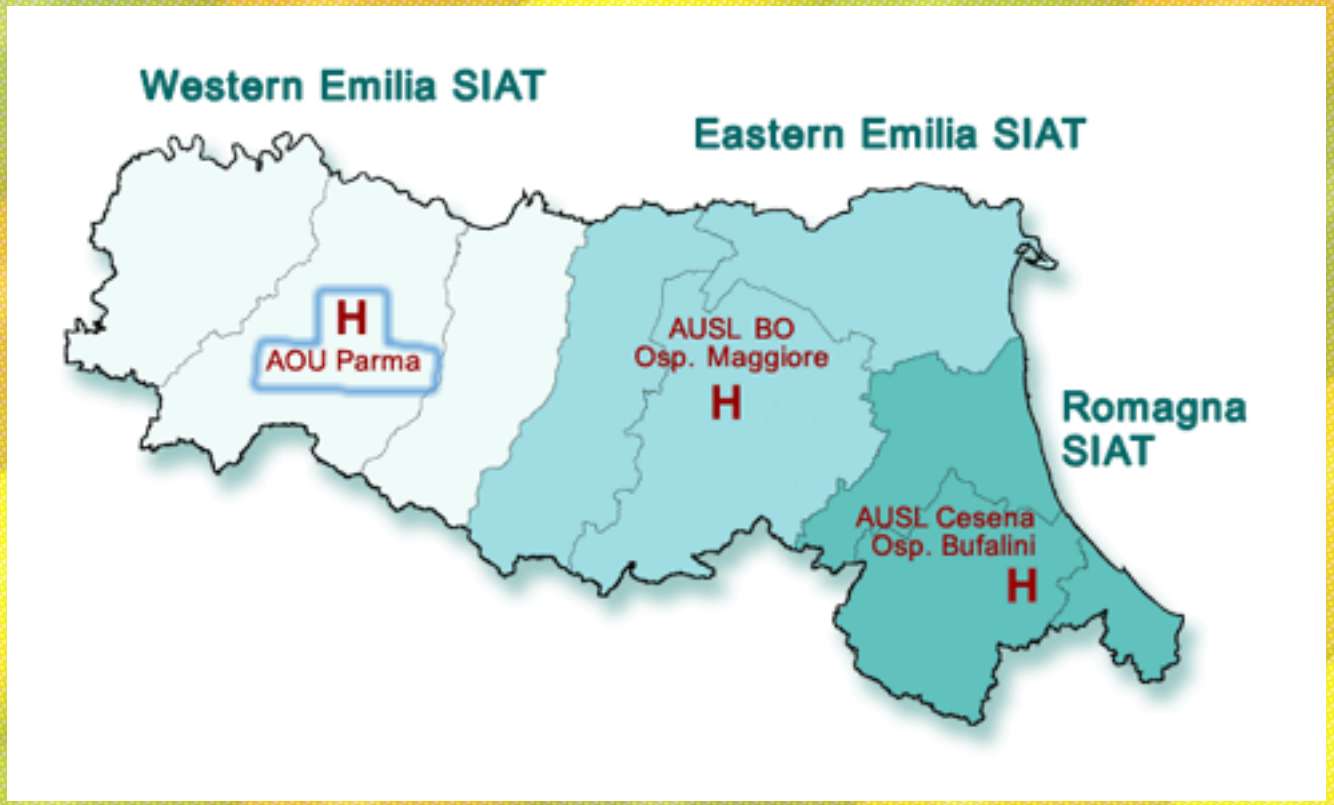
KEY WORDS: Trauma system; trauma service area; geocode.



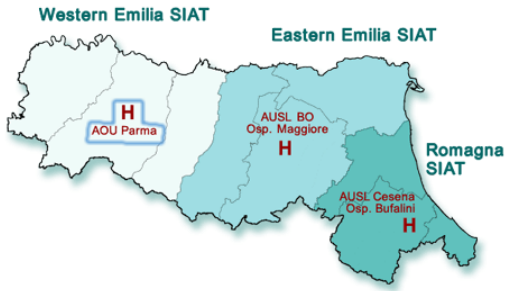
In order to measure the true quality of Trauma Systems

1. A fundamental component of TS that needs measuring is access to care
2. Trauma registries should not be assumed as representative of the population unless proven so (often being in the trauma registry = being in the trauma system **AND VICEVERSA**)
3. Population-based data are fundamental

Emilia-Romagna region, Italy. ~4.5 million inhabitants.



Expected No. of major trauma cases admitted to hospital (350-400/ million = 1800)



Trauma Registry data for 2011 (ISS>15 or ICU)

852 cases from 22 hospitals

Mortality = 11.49 %

ISS mean, median = 22, 23

TMPM- ICD9 mean, median = 0.12, 0.06

ORIGINAL ARTICLES

TMPM–ICD9

A Trauma Mortality Prediction Model Based on ICD-9-CM Codes

Laurent G. Glance, MD, Turner M. Osler, MD,† Dana B. Mukamel, PhD,‡ Wayne Meredith, MD,§ Jacob Wagner, MD, PhD,¶ and Andrew W. Dick, PhD‖*

(*Ann Surg* 2009;249: 1032–1039)

Administrative data *(ED, Hospital Discharge and Mortality data banks) for 2011*

↓

26835 cases admitted with traumatic diagnosis

↓

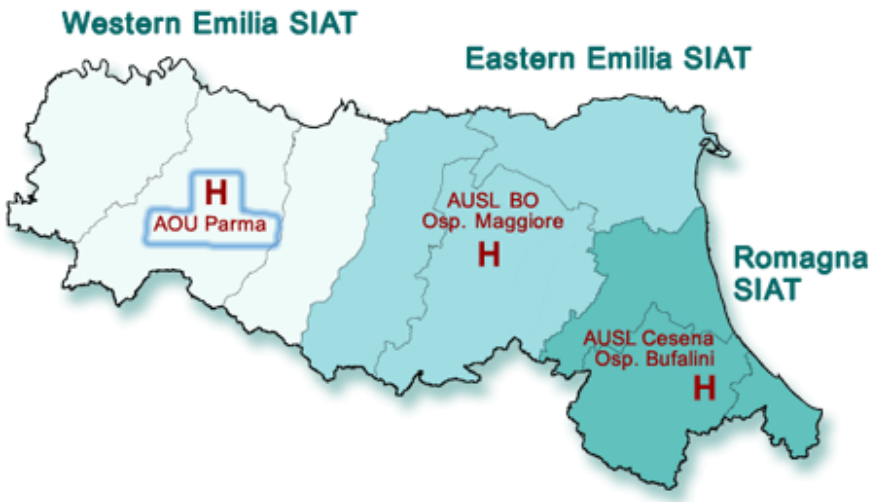
Selection by LOS, TMPM-ICD9, ICU Y/N,Femural neck fx >65y.

↓

1833 cases from 58 hospitals

Mortality 10.37%

TMPM, mean, median 0.15, 0.10



852 from 22 hospitals? or 1833 from 58 hospitals?

ORIGINAL ARTICLE

ONLINE FIRST

Weekend and Night Outcomes in a Statewide Trauma System

Brendan G. Carr, MD, MS; Patrick M. Reilly, MD; C. William Schwab, MD; Charles C. Branas, PhD; Juliet Geiger, RN, MSN; Douglas J. Wiebe, PhD

Arch Surg. Published online March 21, 2011. doi:10.1001/archsurg.2011.60

We demonstrate no difference in adjusted survival for injured patients presenting to the trauma system at night

PATIENT POPULATION

We obtained data for all patients in the PTOS registry who were treated from January 1, 2004, to December 31, 2008. We then excluded children (aged <18 years), patients with a primary diagnosis of a burn, and patients transferred from another facility. The study was approved by the institutional review board at the University of Pennsylvania.

Trauma registry, no transferred pts

```
. xi:logistic trauma_death age gender TMPM_ICD9 night if rrtg==1 & sec==0

Logistic regression                               Number of obs   =        799
                                                  LR chi2(4)      =      87.27
                                                  Prob > chi2     =     0.0000
Log likelihood = -233.45825                       Pseudo R2       =     0.1575

------------------------------------------------------------------------------
trauma_death | Odds Ratio   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   1.040049   .0067312     6.07   0.000     1.026939    1.053326
      gender |   1.052175   .2834818     0.19   0.850     .6205169    1.784114
   TMPM_ICD9 |   1.631618   .1358877     5.88   0.000     1.385885    1.920923
       night |   1.003578   .2832694     0.01   0.990     .5771532    1.745061
------------------------------------------------------------------------------
```

‘Administrative’ registry

```
Logistic regression                               Number of obs   =       1833
                                                  LR chi2(4)      =     109.75
                                                  Prob > chi2     =     0.0000
Log likelihood = -555.58925                       Pseudo R2       =     0.0899

------------------------------------------------------------------------------
trauma_death | Odds Ratio   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   1.036388   .0045764     8.09   0.000     1.027457    1.045396
      gender |   1.224296   .2069936     1.20   0.231     .8789669    1.705299
   TMPM_ICD9 |   1.294758   .0871673     3.84   0.000     1.134705    1.477387
       night |   1.532535   .2667899     2.45   0.014     1.089507    2.155714
------------------------------------------------------------------------------
```

```
-------------------------
-> sec = 0

Logistic regression                                     Number of obs   =       1708
                                                        LR chi2(4)      =      91.94
                                                        Prob > chi2     =     0.0000
Log likelihood = -503.09492                             Pseudo R2       =     0.0837

------------------------------------------------------------------------------
trauma_death | Odds Ratio   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   1.037151    .004913     7.70   0.000     1.027567    1.046826
      gender |   1.236791   .2204705     1.19   0.233     .8720896    1.754008
   TMPM_ICD9 |   1.227472   .0890884     2.82   0.005     1.064713    1.415112
       night |   1.310098   .2462356     1.44   0.151     .9063973    1.893602
------------------------------------------------------------------------------


-------------------------
-> sec = 1

Logistic regression                                     Number of obs   =        125
                                                        LR chi2(4)      =      29.83
                                                        Prob > chi2     =     0.0000
Log likelihood = -43.243915                             Pseudo R2       =     0.2565

------------------------------------------------------------------------------
trauma_death | Odds Ratio   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   1.039181     .01472     2.71   0.007     1.010727    1.068436
      gender |   1.107037   .6843074     0.16   0.869     .3296081    3.718147
   TMPM_ICD9 |   1.950336   .4336599     3.00   0.003     1.261373     3.01561
       night |   6.945358   4.136191     3.25   0.001     2.161603    22.31585
------------------------------------------------------------------------------
```

```
. tabu  night sec, row

+----------------+
| Key            |
|----------------|
|   frequency    |
| row percentage |
+----------------+

           |          sec
     night |         0          1 |     Total
-----------+----------------------+----------
         0 |     1,238         90 |     1,328
           |     93.22       6.78 |    100.00
-----------+----------------------+----------
         1 |       470         35 |       505
           |     93.07       6.93 |    100.00
-----------+----------------------+----------
     Total |     1,708        125 |     1,833
           |     93.18       6.82 |    100.00
```

Conclusions:

- TS QIs do exist, but thay are poorly evidence-based and agreed upon
- There is much room for improvement if we:
  - Select areas where evidence is available
  - Organise consensus on QI lacking direct evidence (face validity)
  - Use population-based (administrative) data