Trauma triage

Where have we been and where are we going?

10 Leading Causes of Death by Age Group, United States – 2006

Rank	Age Groups										
	<1	1-4	5-9	10-14	15-24	25-34	35-44	45-54	55-64	65+	Total
1	Congenital Anomalies 5,819	**Unintentional Injury 1,610**	**Unintentional Injury 1,044**	**Unintentional Injury 1,214**	**Unintentional Injury 16,229**	**Unintentional Injury 14,954**	**Unintentional Injury 17,534**	Malignant Neoplasms 50,334	Malignant Neoplasms 101,454	Heart Disease 510,542	Heart Disease 631,636
2	Short Gestation 4,841	Congenital Anomalies 515	Malignant Neoplasms 459	Malignant Neoplasms 448	**Homicide 5,717**	**Suicide 4,985**	Malignant Neoplasms 13,917	Heart Disease 38,095	Heart Disease 65,477	Malignant Neoplasms 387,515	Malignant Neoplasms 559,888
3	SIDS 2,323	Malignant Neoplasms 377	Congenital Anomalies 182	**Homicide 241**	**Suicide 4,189**	**Homicide 4,725**	Heart Disease 12,339	**Unintentional Injury 19,675**	Chronic Low. Respiratory Disease 12,375	Cerebro-vascular 117,010	Cerebro-vascular 137,119
4	Maternal Pregnancy Comp. 1,683	**Homicide 366**	**Homicide 149**	**Suicide 216**	Malignant Neoplasms 1,664	Malignant Neoplasms 3,656	**Suicide 6,591**	Liver Disease 7,712	**Unintentional Injury 11,446**	Chronic Low. Respiratory Disease 106,845	Chronic Low. Respiratory Disease 124,583
5	**Unintentional Injury 1,147**	Heart Disease 161	Heart Disease 90	Heart Disease 163	Heart Disease 1,076	Heart Disease 3,307	HIV 4,010	**Suicide 7,426**	Diabetes Mellitus 11,432	Alzheimer's Disease 71,660	**Unintentional Injury 121,599**
6	Placenta Cord Membranes 1,140	Influenza & Pneumonia 125	Chronic Low. Respiratory Disease 52	Congenital Anomalies 162	Congenital Anomalies 460	HIV 1,182	**Homicide 3,020**	Cerebro-vascular 6,341	Cerebro-vascular 10,518	Diabetes Mellitus 52,351	Diabetes Mellitus 72,449
7	Respiratory Distress 825	Septicemia 88	Cerebro-vascular 45	Chronic Low. Respiratory Disease 63	Cerebro-vascular 210	Diabetes Mellitus 673	Liver Disease 2,551	Diabetes Mellitus 5,692	Liver Disease 7,217	Influenza & Pneumonia 49,346	Alzheimer's Disease 72,432
8	Bacterial Sepsis 807	Perinatal Period 65	Influenza & Pneumonia 40	Cerebro-vascular 50	HIV 206	Cerebro-vascular 527	Cerebro-vascular 2,221	HIV 4,377	**Suicide 4,583**	Nephritis 37,377	Influenza & Pneumonia 56,326
9	Neonatal Hemorrhage 618	Benign Neoplasms 60	Septicemia 40	Septicemia 44	Influenza & Pneumonia 184	Congenital Anomalies 437	Diabetes Mellitus 2,094	Chronic Low. Respiratory Disease 3,924	Nephritis 4,368	**Unintentional Injury 36,689**	Nephritis 45,344
10	Circulatory System Disease 543	Cerebro-vascular 54	Benign Neoplasms 38	Benign Neoplasms 38	Complicated Pregnancy 179	Influenza & Pneumonia 335	Septicemia 870	Viral Hepatitis 2,911	Septicemia 4,032	Septicemia 26,201	Septicemia 34,234

Source: National Vital Statistics System, National Center for Health Statistics, CDC.
Produced by: Office of Statistics and Programming, National Center for Injury Prevention and Control, CDC.

National Center for Injury Prevention and Control, Centers for Disease Control and Prevention. Web-based Injury Statistics Query and Reporting System. Ten Leading Causes of Death, 1999-2004.

Historical Context

Pre-1970s	Injured patients taken to nearest hospital
1976	ACS-COT publishes the first guideline for trauma centers: *Optimal Hospital Resources for the Care of the Injured Patient*
1987	National consensus conference first field triage protocol: *Triage Decision Scheme*
1990-2006	Revisions x 4; *Resources for the Optimal Care of the Injured Patient*
2005	CDC publishes an Injury Care Research Agenda
2006	CDC and National Highway Traffic Safety Administration produce a revised *Field Triage Decision Scheme*

BOX 2. Levels of trauma centers (TCs)

Level I
- Regional resource hospital that is central to trauma care system
- Provides total care for every aspect of injury, from prevention through rehabilitation
- Maintains resources and personnel for patient care, education, and research (usually in university-based teaching hospital)
- Provides leadership in education, research, and system planning to all hospitals caring for injured patients in the region

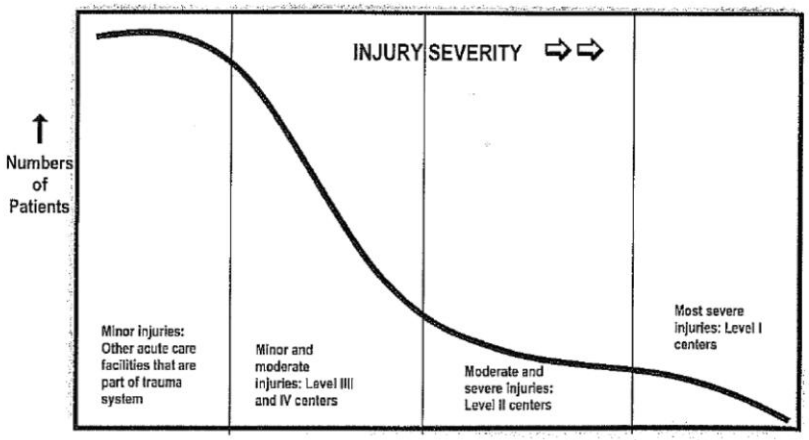
Level II
- Provides comprehensive trauma care, regardless of the severity of injury
- Might be most prevalent facility in a community and manage majority of trauma patients or supplement the activity of a Level I TC
- Can be an academic institution or a public or private community facility located in an urban, suburban, or rural area
- Where no Level I TC exists, is responsible for education and system leadership

Level III
- Provides prompt assessment, resuscitation, emergency surgery, and stabilization and arrange transfer to a higher-level facility when necessary
- Maintains continuous general surgery coverage
- Has transfer agreements and standardized treatment protocols to plan for care of injured patients
- Might not be required in urban or suburban area with adequate Level I or II TCs

Level IV
- Rural facility that supplements care within the larger trauma system
- Provides initial evaluation and assessment of injured patients
- Must have 24-hour emergency coverage by a physician
- Has transfer agreements and a good working relationship with the nearest Level I, II, or III TC

SOURCE: Adapted from the American College of Surgeons. Resources for the optimal care of the injured pa

Figure 2. The Inclusive Trauma System

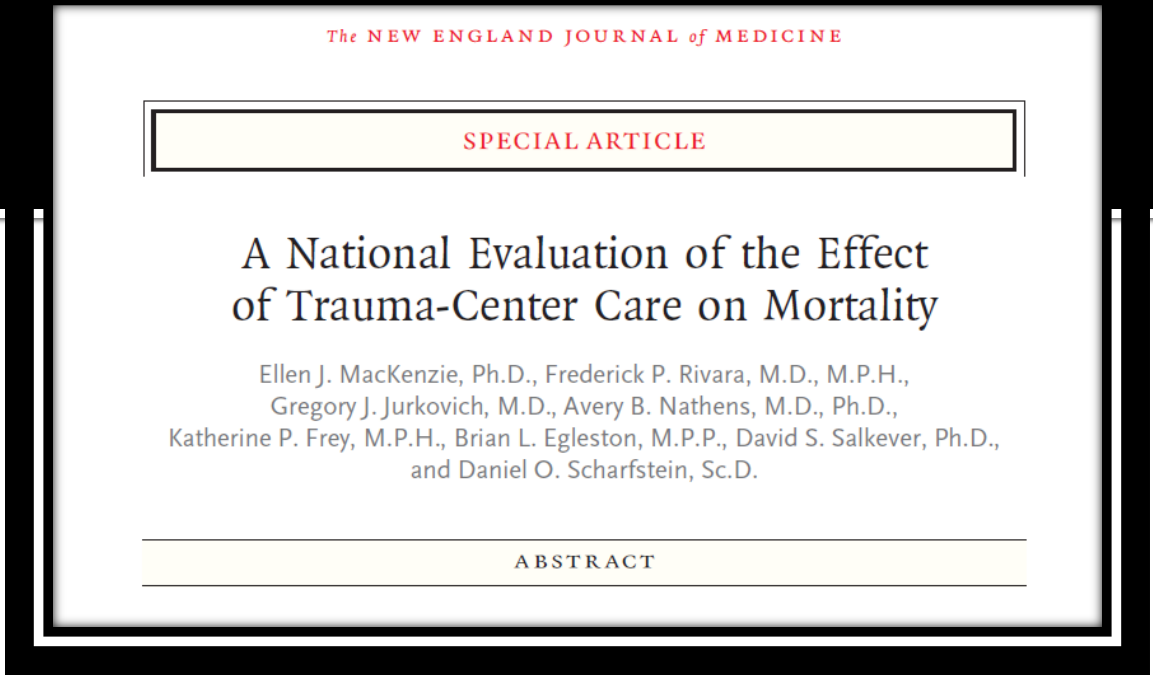


The *inclusive* trauma system uses the full spectrum of acute care facilities to provide trauma care.

Resources for Optimal Care of the Injured Patient 200

"Inclusive trauma system"

Involves all components of trauma care such as prevention, acute hospital care, rehabilitation, and research



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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.

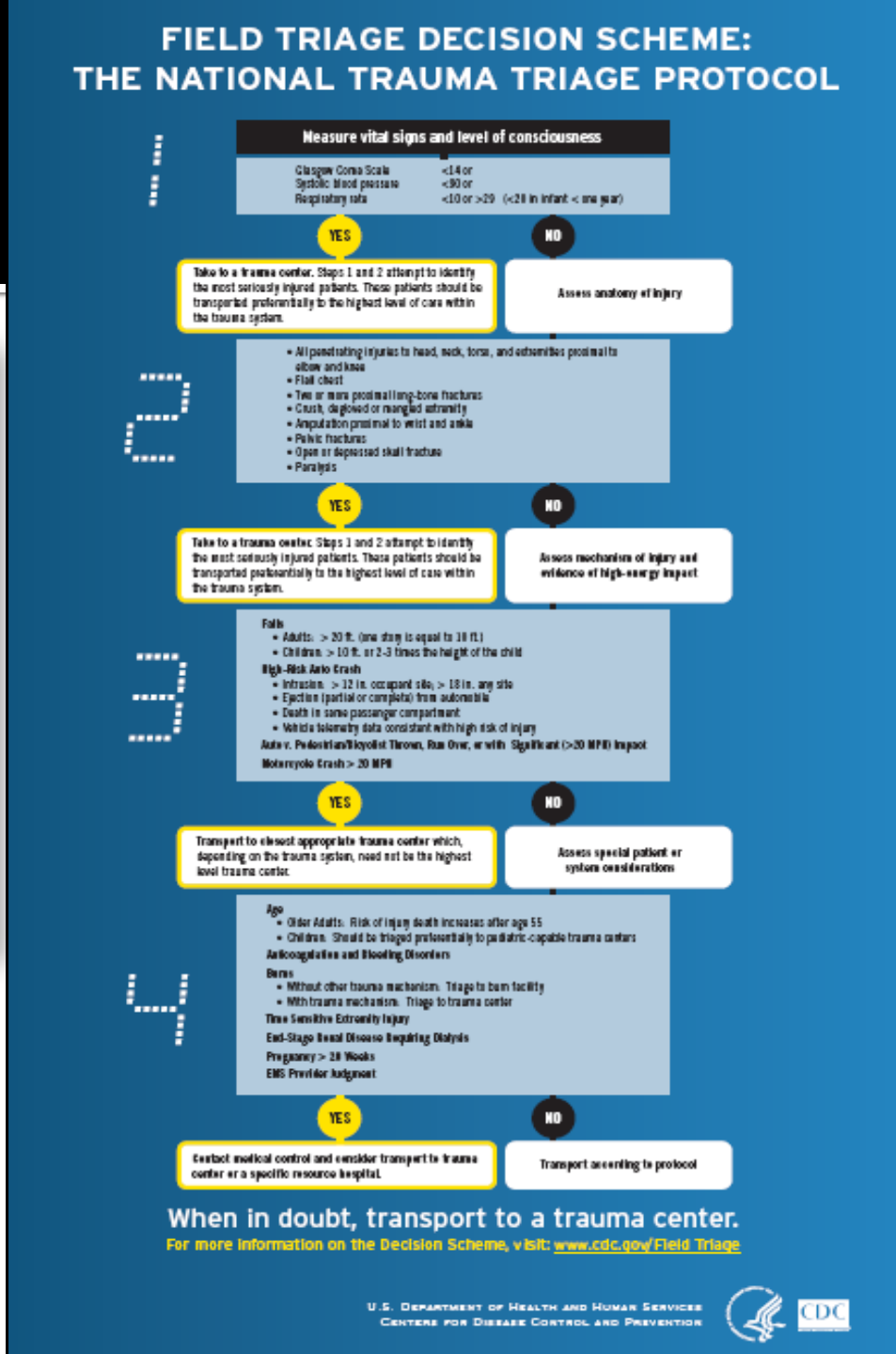
ABSTRACT

- Compared patients treated at 18 Level 1 hospitals to 51 non-trauma centers in 14 states.
- Controlled for differences in case mix.
- Found improved mortality rates for patients treated at trauma centers
  - RR in-hospital mortality 0.8 (7.6% vs. 9.5% mortality)
  - RR one-year mortality 0.75 (10.4% vs. 13.8% mortality)

Four Steps for Triage

Assess:

1. Physiology
2. Anatomy
3. Mechanism
4. Special Circumstances



Field Triage Accuracy

- "Under-triage"

  Triage decision that classifies patient as not needing a trauma center when they do

  - May lead to adverse patient outcomes
  - Should be 0-5%

- "Over-triage"

  Triage decision that results in patients who could have been treated at non-trauma center to a trauma center

  - Leads to overutilization of limited trauma center resources
  - Should be 25-50%

A Critical Assessment of the Out-of-Hospital Trauma Triage Guidelines for Physiologic Abnormality

Craig D. Newgard, MD, MPH, Kyle Rudser, PhD, Jerris R. Hedges, MD, MS, MMM, Jeffrey D. Kerby, MD, PhD, Ian G. Stiell, MD, MSc, FRCPC, Daniel P. Davis, MD, Laurie J. Morrison, MD, MSc, FRCPC, Eileen Bulger, MD, Tom Terndrup, MD, Joseph P. Minei, MD, Berit Bardarson, RN, and Scott Emerson, MD, PhD; the ROC Investigators

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- Relevance of the "Step 1" physiologic criteria
  - Incidence of mortality and prolonged stay based on criteria
  - Assess for new physiologic criteria
- Population-based data
  - 207 acute care hospitals in 11 regions
  - Trauma and non-trauma centers

A Critical Assessment of the Out-of-Hospital Trauma Triage Guidelines for Physiologic Abnormality

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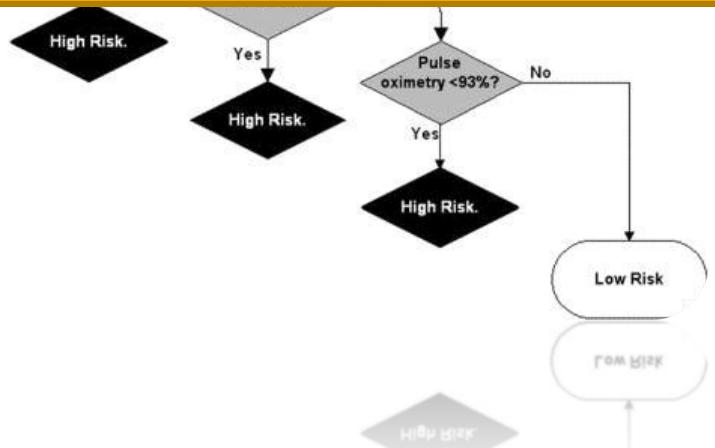
- 42% patients that met Step 1 criteria were discharged home within 2 days

Conclusions: We were unable to omit or further restrict any ACSCOT step 1 physiologic measures in a decision rule practical for field use without missing high-risk trauma patients.



Specificity	0.69 (0.67–0.72)
Positive predictive value	0.77 (0.74–0.79)
negative predictive value	0.64 (0.61–0.67)
Positive likelihood ratio	2.36 (2.13–2.59)
Negative likelihood ratio	0.40 (0.37–0.44)

* The same decision tree (and accuracy measures) was generated when using only physiologic predictors or both physiologic and demographic predictors.

Challenges

- Variable definitions for MT
  - Number of patients taken to a non-trauma center who died
  - Number of patients with an ISS>15 who were taken to a non-trauma center
  - Length of hospitalization >48 hours
- Incomplete data from pre-hospital to discharge
- Data which captures information on regions rather than hospitals
- ACSCOT criteria were never intended to provide cost-effective or resource-efficient care

Goal: Better match injured patients with resources through improved triage criteria

- Multi-site trial
  - Portland, OR/Vancouver, WA
  - King County, WA
  - Birmingham, AL
  - Sacramento, CA
  - San Francisco, CA
  - Santa Clara/San Mateo CA
  - Salt Lake City, UT
  - Denver, CO
- Collects
  - All injured-persons data for catchment area (including patients sent to non-trauma centers)
  - All outcome data on these injured patients

Summary

- Trauma triage is in constant evolution
- Goal is to match patient needs to resources in a cost-effective and outcomes-oriented way
- Research indicates trauma systems are good, but triage research is still needed
- New research focused on patient outcomes from a population perspective is underway