Medical Care of Severe Road Trauma Patient

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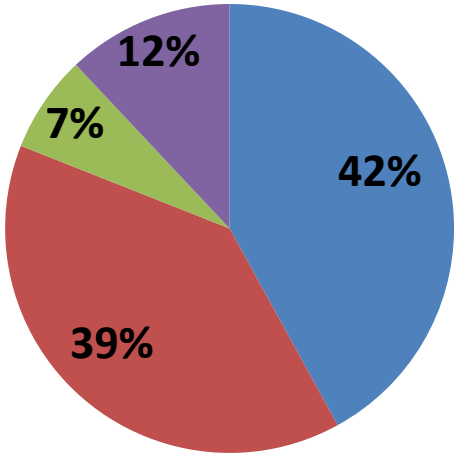
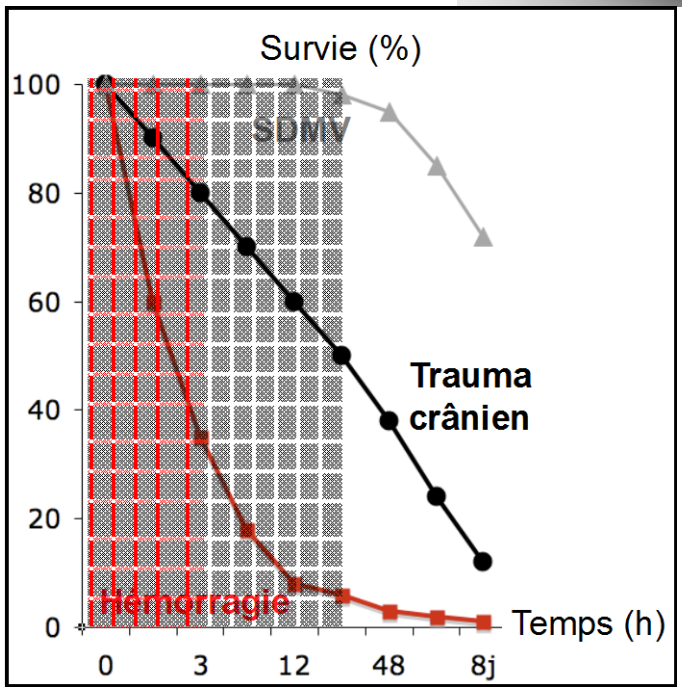
Severe trauma: epidemiology

Mortality

- Traumatic brain injury
- Hemorrhage
- Multiple organ failure
- others causes





Spahn et al. *Critical Care* 2013,17:R76
Shapiro MB et al. *J Trauma* 2000;49:969-78
Shackford SR et al. *Arch Surg* 1993;128:571-575

Sauaia A et al. *J Trauma* 1995;38:185-93

Every trauma patient should be considered as a spine trauma

Severe Trauma

- Post trauma deaths repartition
  - Immédiate death: ≤ 1 hour : 50%
  - Early death : 1-5 hours : 30%
  - Late death : 1-5 Weeks : 20%
- Preventable death :
  - 30% can be saved with a better medical organization

Cayten, Ann Surg 1991

Trauma Management

- Depend:
  - on the trauma care organisation
  - on the level of development of the country

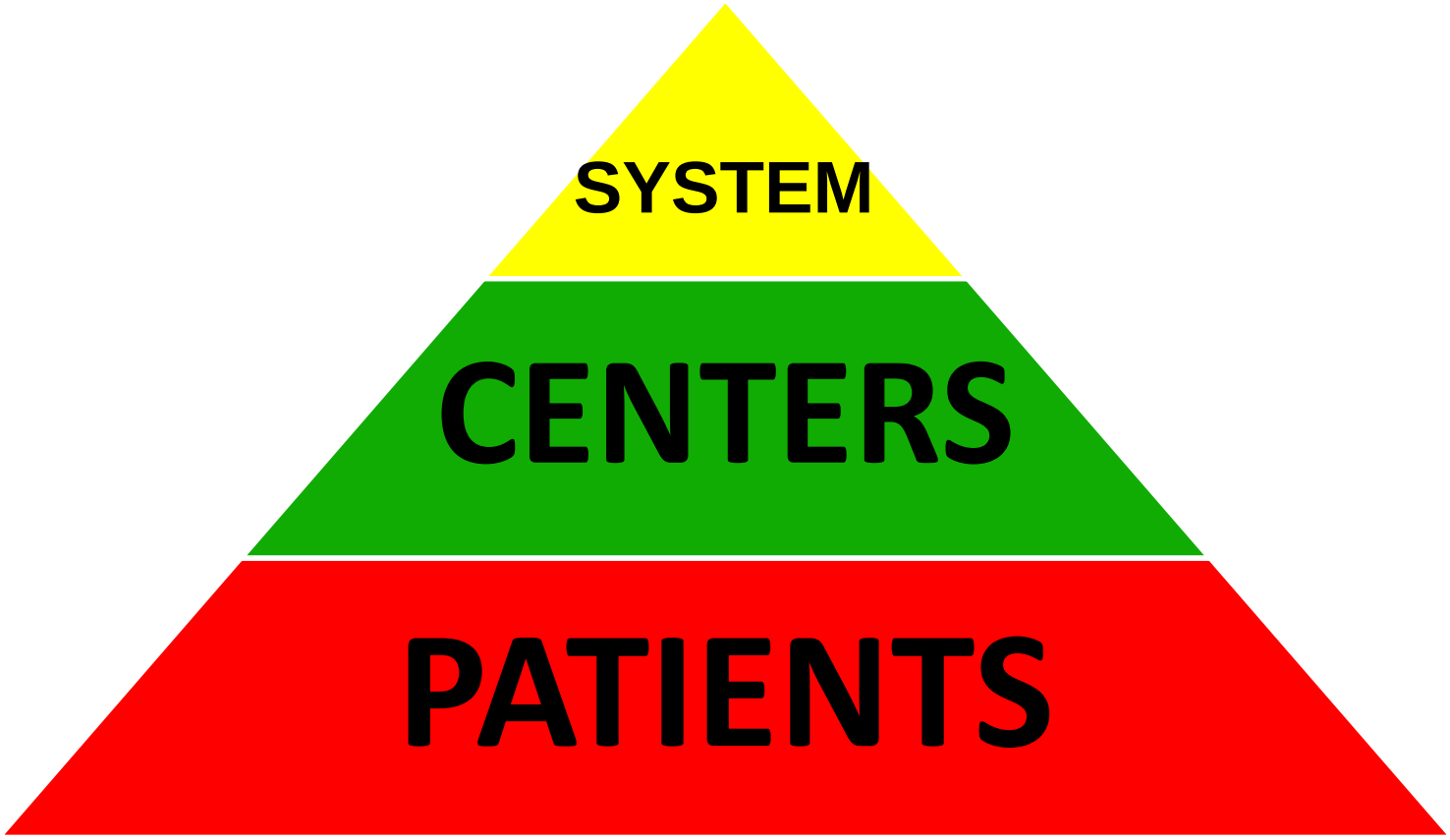
- Severe trauma: major health problem (Young accident victims)

- 2 million lives could be saved each year if care provided were the same as in the developed country(Mock WJ Surg 2012)

- Success Keys: Care organisation-team experience-regular training

The North america exemple

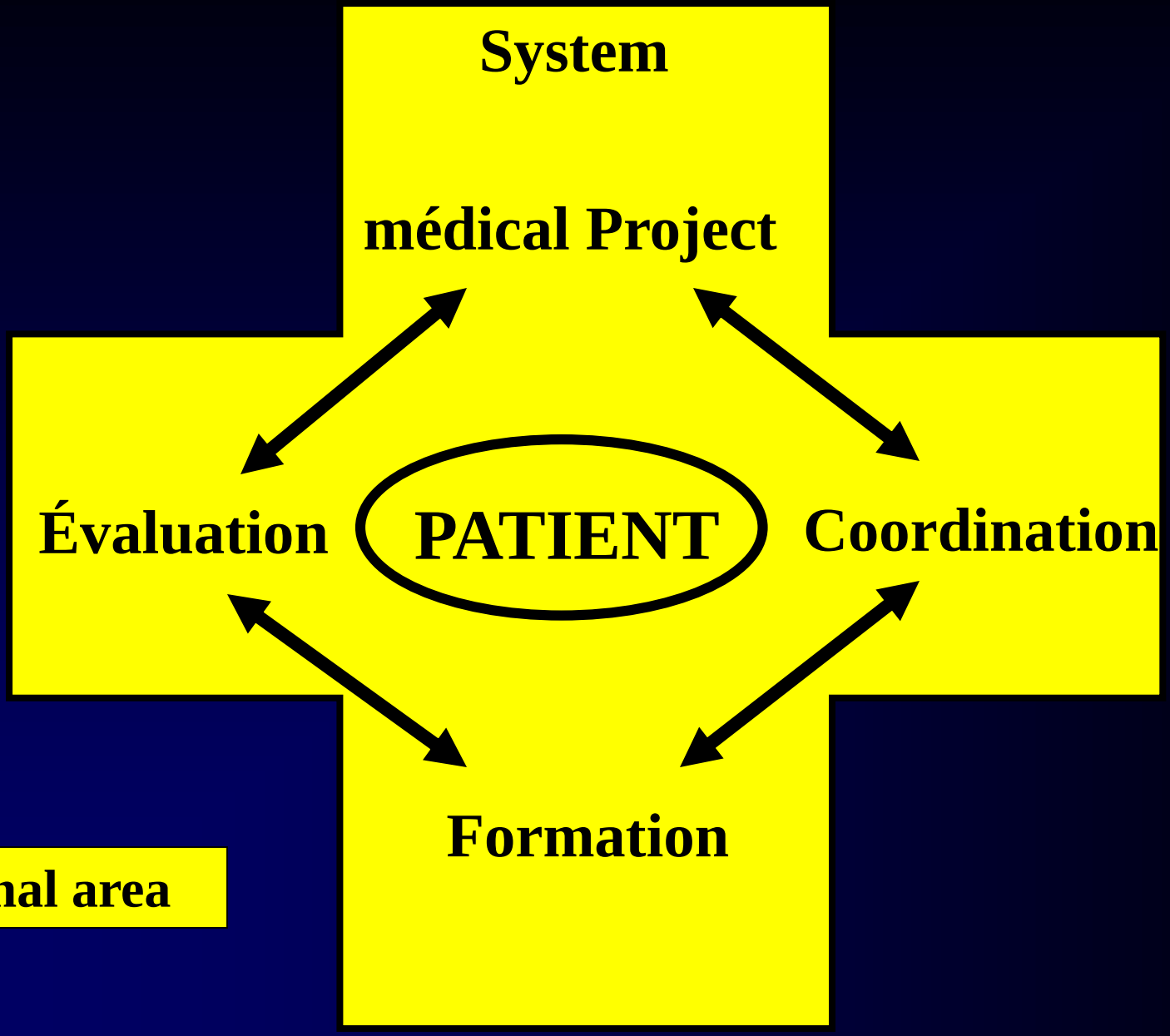
Trauma organisation



Trauma system

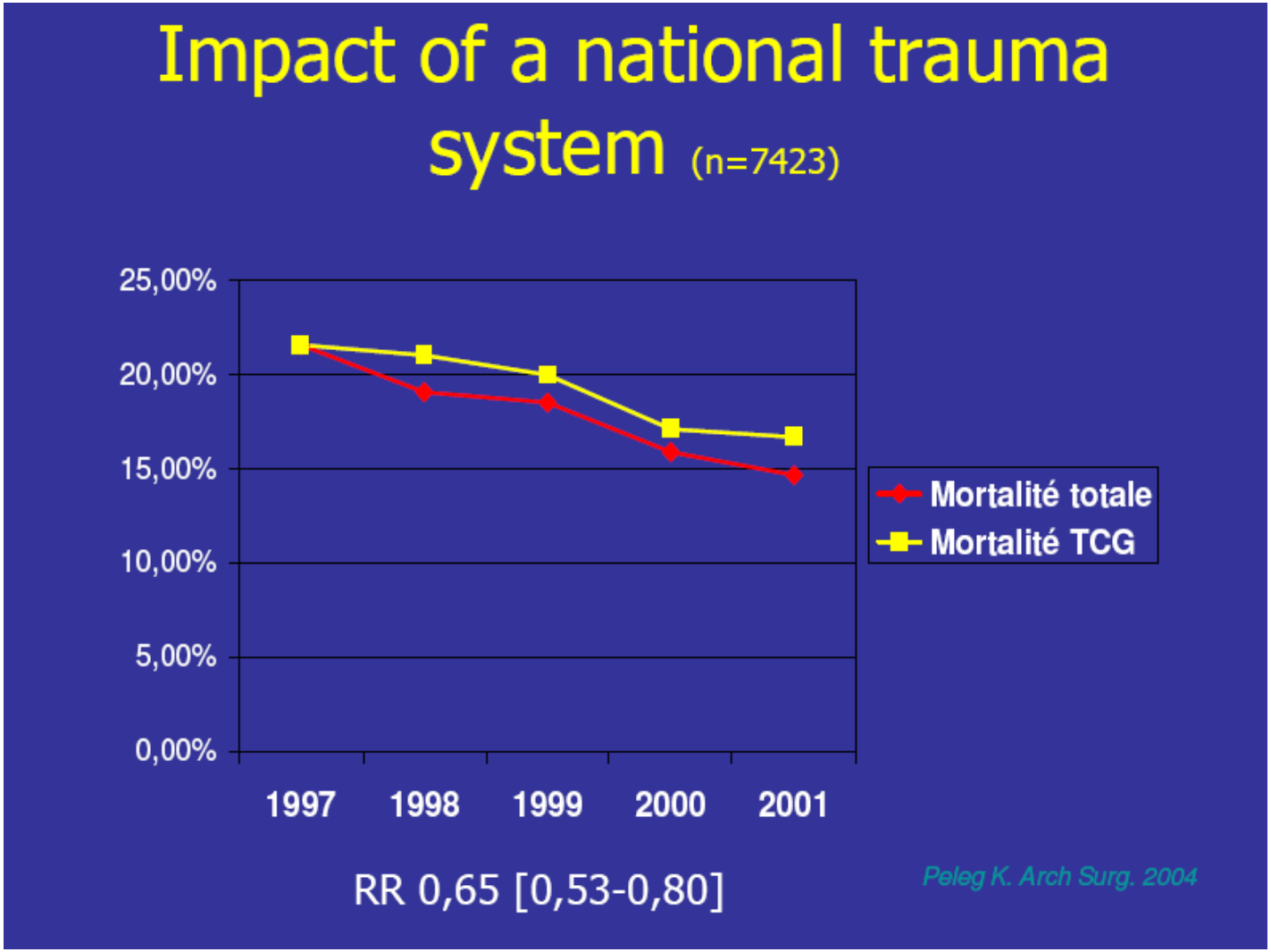
A trauma system = organized approach for facilitating multidisciplinary system response to severely injured patients:

- in a defined geographic area
- that delivers the full range of services
- to all trauma patients
- and is integrated with the public health system for injury prevention and surveillance



Régional area

Trauma System effect



Relationship Between American College of Surgeons Trauma Center Designation and Mortality in Patients with Severe Trauma (Injury Severity Score > 15)

Demetrios Demetriades, MD, PhD, FACS, Matthew Martin, MD, Ali Salim, MD, Peter Rhee, MD, FACS, Carlos Brown, MD, Jay Doucet, MD, FACS, Linda Chan, PhD

BACKGROUND: We studied the association of the American College of Surgeons (ACS) trauma center designation and mortality in adult patients with severe trauma (Injury Severity Score > 15). ACS designation of trauma centers into different levels requires substantial financial and human resources commitments. There is very little work published on the association of ACS trauma center designation and outcomes in severe trauma.

STUDY DESIGN: National Trauma Data Bank study including all adult trauma admissions (older than 14 years of age) with Injury Severity Score (ISS) > 15. The relationship between ACS level of trauma designation and survival outcomes was evaluated after adjusting for age, mechanism of injury, ISS, hypotension on admission, severe liver trauma, aortic, vena cava, iliac vascular, and pene-

ACS designation	No. of facilities	No. of trauma cases with ISS > 15	Unadjusted death rate	Unadjusted odds ratio (95% CI)	Adjusted odds ratio (95% CI)*	Adjusted p value*
Level I	45	51,923	14.9	1.00	1.00	
Level II	39	19,131	15.4	1.04 (0.99–1.09)	1.14 (1.09–1.20)	< 0.0001
Level III	5	210	18.6	1.31 (0.91–1.88)	1.17 (0.75–1.76)	0.46
Undesignated	167	61,223	18.2	1.28 (1.24–1.32)	1.09 (1.05–1.13)	< 0.0001

The NEW ENGLAND JOURNAL of MEDICINE

SPECIAL ARTICLE

N Engl J Med 2006;354:366-78.

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

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
Maximal AIS score, 5–6	1,969				
Trauma center (%)		30.2	29.4	31.4	31.8
Non–trauma center (%)		43.2	43.9	44.4	44.4
Relative risk (95% CI)		0.70 (0.51–0.96)	0.67 (0.48–0.92)	0.71 (0.52–0.97)	0.72 (0.52–0.98)

Direct transfer to Trauma center !

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.

N ENGL J MED 354;4 JANUARY 26, 2006

- 18 level-1 trauma centers *VS* 51 non-trauma centers

-> 1104 death patients and 4087 patients alife when leaving hospital

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.*

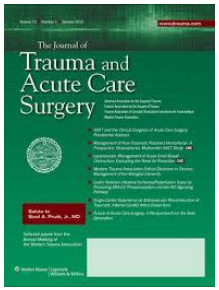
Variable	Weighted No. of Patients	Death in Hospital	Death within 30 Days after Injury	Death within 90 Days after Injury	Death within 365 Days after Injury
Overall population	15,009				
Trauma center (%)		7.6	7.6	8.7	10.4
Non–trauma center (%)		9.5	10.0	11.4	13.8
Relative risk (95% CI)		0.80 (0.66–0.98)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

* CI denotes confidence interval, and AIS Abbreviated Injury Scale.

Direct Transfert to Trauma center

Directness of Transport of Major Trauma Patients to a Level I Trauma Center: A Propensity-Adjusted Survival Analysis of the Impact on Short-Term Mortality (*J Trauma.* 2011;70: 1118–1127)

Tabitha Garwe, PhD, Linda D. Cowan, PhD, Barbara R. Neas, PhD, John C. Sacra, MD, and Roxie M. Albrecht, MD



- Retrospective monocentric study = level-1 trauma center
  - Comparison of patients directy admitted*VS* transfered ->

1398 patients directly admitted VS 600 patients transfered

TABLE 4. Multivariate Analyses of the Association of Directness of Transport and Short-Term Mortality Outcomes in Major Trauma Patients Treated at a Level I Trauma Center

	24-h Mortality HR (95% CI)	2-wk Mortality HR (95% CI)	>2 wk HR (95% CI)*
Transfer	1.67 (0.57–4.8)	2.71 (1.31–5.6)	2.86 (0.67–12.2)
Propensity score†	0.73 (0.23–2.29)	1.63 (0.8–3.35)	3.18 (0.4–24.1)
Time to Level I care	0.66 (0.49–0.92)	0.76 (0.63–0.91)	
Age, yr		1.01 (1.01–1.02)	1.08 (1.04–1.12)
ISS	1.03 (1.01–1.04)	1.03 (1.02–1.05)	1.01 (0.96–1.06)
Severe head injury	3.73 (1.98–7.02)	4.45 (2.8–7.1)	
Comorbid present	2.07 (1.32–3.24)	1.48 (1.06–2.06)	
Shock (SBP <100)	3.03 (1.9–4.8)	2.24 (1.58–3.17)	
EMS or ED intubation	3.12 (1.9–5.27)	2.18 (1.54–3.08)	

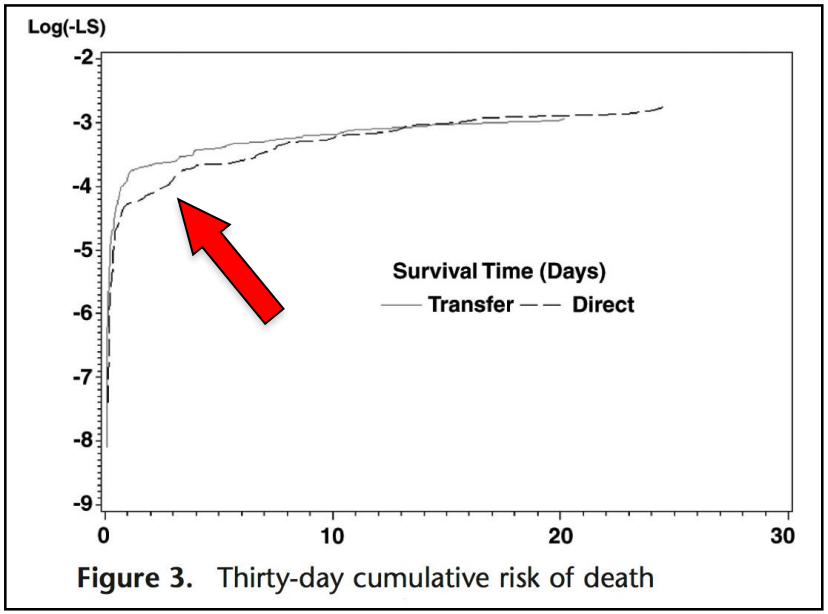
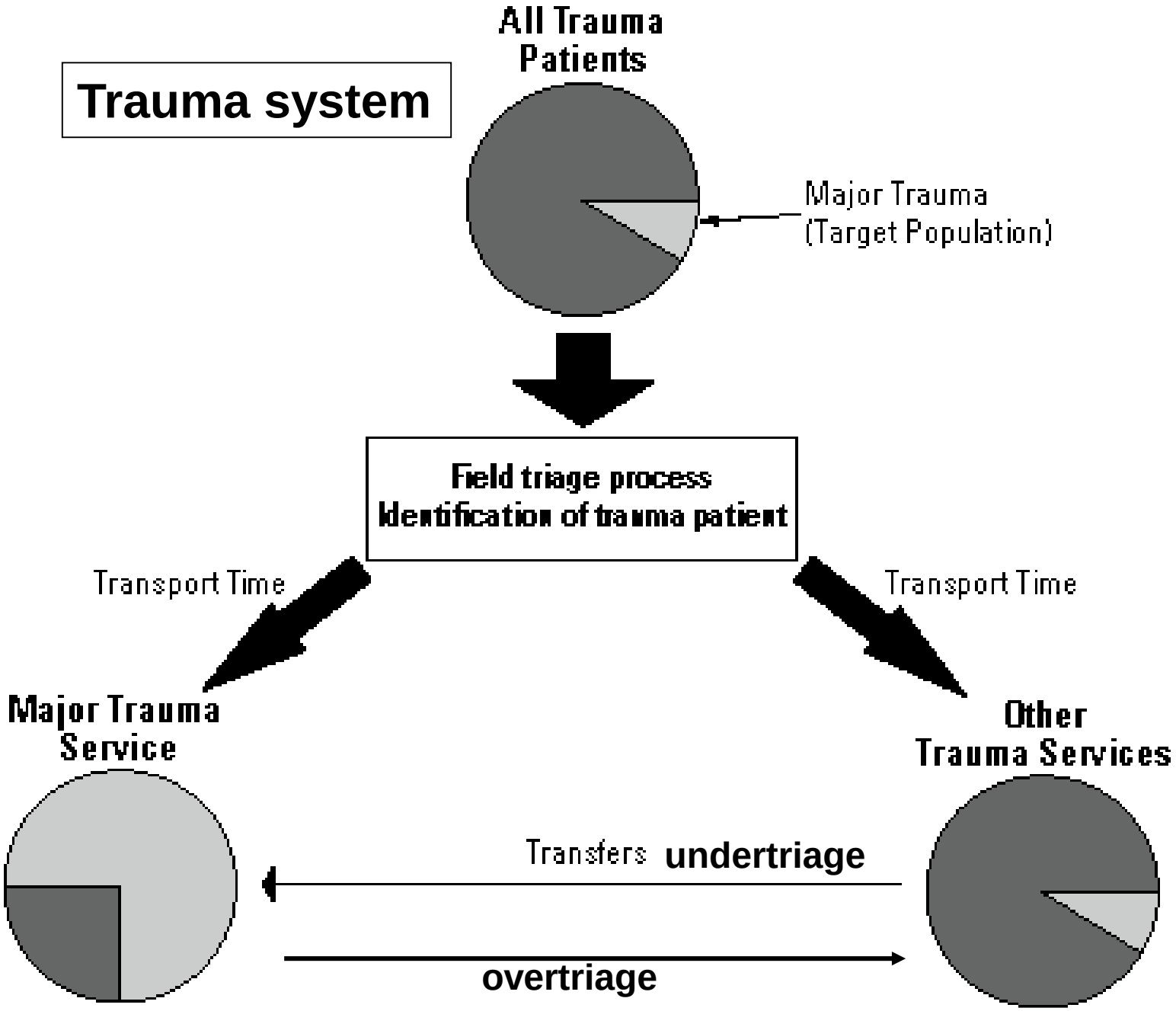


Figure 3. Thirty-day cumulative risk of death


Trauma system
All Trauma Patients
Major Trauma (Target Population)
Field triage process Identification of trauma patient
Transport Time
Transport Time
Major Trauma Service
Other Trauma Services
Transfers undertriage
overtriage

JAMA®

Relationship Between Trauma Center Volume and Outcomes

Avery B. Nathens; Gregory J. Jurkovich; Ronald V. Maier; et al.

Table 3. Crude Mortality as a Function of Trauma Center Volume in Patients With Penetrating Abdominal Injury

	Total Major Trauma Admissions per y				
No. (%) of Patients	≤315	316-415	416-650	>650	*P* Value
No shock	2/100 (2)	5/96 (5)	3/119 (3)	6/115 (5)	.50
Shock	0/2 (0)	3/4 (75)	9/14 (64)	4/16 (25)	.05

Table 5. Crude Mortality as a Function of Trauma Center Volume in Patients With Multisystem Blunt Trauma Injury

	Total Major Trauma Admissions per y				
No. (%) of Patients	≤315	316-415	416-650	>650	*P* Value
No coma	1/56 (2)	7/163 (4)	4/70 (6)	11/94 (12)	.05
Coma	13/23 (57)	29/58 (50)	6/15 (40)	11/46 (24)	.02

Trauma-related Preventable Deaths in Berlin 2010: Need to Ma

C. K
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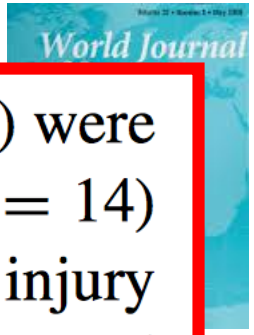

Results Of the fatalities recorded, 84.9 % ($n = 224$) were classified as NP, 9.8 % ($n = 26$) as PP, and 5.3 % ($n = 14$) as DP. The incidence of severe traumatic brain injury (sTBI) was significantly lower in PP/DP than in NP, and the incidence of fatal exsanguinations was significantly higher. Most PP and NP deaths occurred in the prehospital setting. Notably, no PP or DP was recorded for fatalities treated by a HEMS crew. Causes of DP deaths consisted of tension pneumothorax, unrecognized trauma, exsanguinations, asphyxia, and occult bleeding with a false negative computed tomography scan.

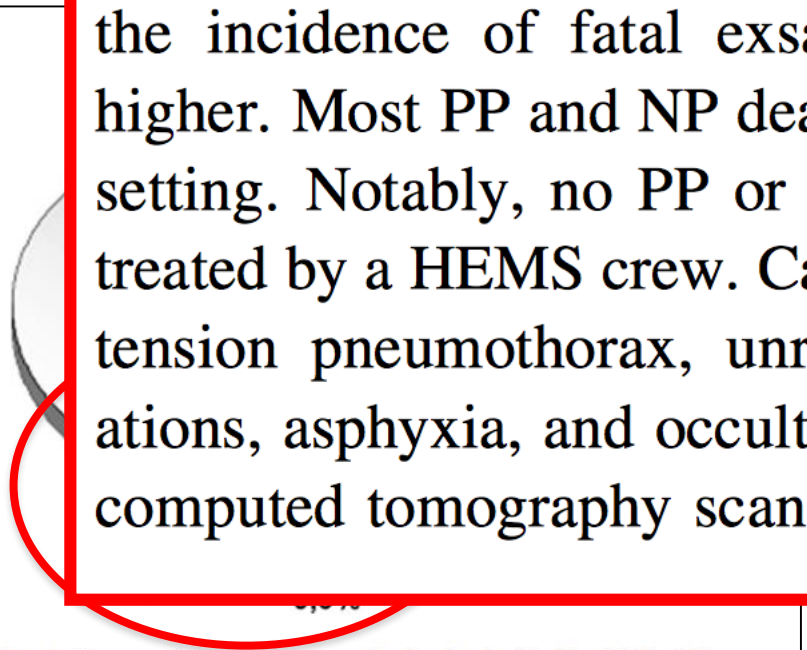

Fig. 1 Preventability of traumatic deaths in Berlin 2010; *NP* non-preventable, *PP* potentially preventable, *DP* definitely preventable

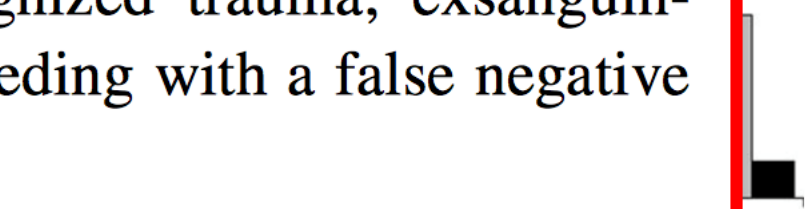

Fig. 2 Localization of death in relation to the preventability of traumatic death. *ED* emergency department, *OR* operating room, *ICU* intensive care unit

0022-5282/93/3402-0216$03.00/0
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THE ROLE OF SECONDARY BRAIN INJURY IN DETERMINING OUTCOME FROM SEVERE HEAD INJURY

Randall M. Chesnut, MD,[a,b] Lawrence F. Marshall, MD,[a] Melville R. Klauber, PhD,[c] Barbara A. Blunt, MPH,[c] Nevan Baldwin, MD,[d] Howard M. Eisenberg, MD,[e] John A. Jane, MD,[f] Anthony Marmarou, PhD,[d] and Mary A. Foulkes PhD[g]

As triage and resuscitation protocols evolve, it is critical to determine the major extracranial variables influencing outcome in the setting of severe head injury. We prospectively studied the [illegible] score ≤ 8) in 717 cases in the Trau[illegible]outcome of hypotension[illegible]anosis in the fie[illegible] Hypoxi[illegible]in morbi[illegible] detrim[illegible] increas[illegible]ia to an extra[illegible] hypotension. In[illegible]ave not markedly altered the [illegible]hypotension are common and detrimental secondary [illegible]ypotension, particularly, is a major determinant of outcome from severe head injury. Resuscitation protocols for brain injured patients should assiduously avoid hypovolemic shock on an absolute basis.

During prehospital phase : Hypotension et hypoxia => mortality enhanced by 150%

THE FRENCH WAY OF LIFE

«*in theory*»

SAMU/SMUR

(1) The hospital is transported to the patient

(2) Resuscited patient is transported directly to the most adapted hospital

Call center: Immediate responses

- Phone advices for witness / injured:
  - Prevent secondary accidents
  - Protect victims and witnesses

- Alert the emergency call center
  - Give complete informations on the accident and the injured patients

- First aid
  - Assist the patients without worsening the injuries

HOW DOES THE SYSTEM WORK ?

Non supposed severe casualty

More severe than expected ?

Fire Department Dispatch

HOW DOES THE SYSTEM WORK ?

Casualty is expected to be severe

Step 1 (Physiological signs)

GCS < 13 &/or
SAP < 90 &/or
Sp02 < 90%

Vittel Triage Criteria. Riou B et al. 2002

no

Step 2 (Global assessment of speed and mechanism)

Ejection from vehicule
Death in same passenger compartment
Fall > 6m
Victim thrown or projected
Global assessment of speed and potential injuries :
Vehicle deformation, estimated vehicle speed, no helmet, no seat belt
Blast

no

Step 3 (Anatomical injuries)

Penetrating trauma of head, neck, thorax, abdomen, arms or legs)
Flail chest
Severe burn
Pelvic fracture
Suspicion of medullar injury
Amputation at or above wrist or ankle level
Acute limb ischemia

no

Step 4 (resuscitation)

Assisted ventilation
Volume load > 1000 mL colloids
Vasopressor
Shock trousers

no

Step 5 (medical history)

Age > 65 y/o
Cardiac insufficiency, respiratory failure, or ischemic heart disease
Pregnancy (2nd and 3rd trimester)
Coagulation problems

no

No trauma center

Guidelines for Field Triage of Injured Patients
Recommendations of the National Expert Panel on Field Triage, 2011

Measure vital signs and level of consciousness

Step One

Glasgow Coma Scale	≤13
Systolic Blood Pressure (mmHg)	<90 mmHg
Respiratory rate	<10 or >29 breaths per minute* (<20 in infant aged <1 year), or need for ventilatory support

No

Assess anatomy of injury

Step Two§

- All penetrating injuries to head, neck, torso and extremities proximal to elbow or knee
- Chest wall instability or deformity (e.g., flail chest)
- Two or more proximal long-bone fractures
- Crushed, degloved, mangled, or pulseless extremity
- Amputation proximal to wrist or ankle
- Pelvic fractures
- Open or depressed skull fracture
- Paralysis

Yes → Transport to a trauma center.† Steps One and Two attempt to identify the most seriously injured patients. These patients should be transported preferentially to the highest level of care within the defined trauma system.

No

Assess mechanism of injury and evidence of high-energy impact

Step Three§

- Falls
  - — Adults: >20 feet (one story is equal to 10 feet)
  - — Children¶: >10 feet or two or three times the height of the child
- High-risk auto crash
  - — Intrusion,** including roof: >12 inches occupant site; >18 inches any site
  - — Ejection (partial or complete) from automobile
  - — Death in same passenger compartment
  - — Vehicle telemetry data consistent with a high risk of injury
- Auto vs. pedestrian/bicyclist thrown, run over, or with significant (>20 mph) impact††
- Motorcycle crash >20 mph

Yes → Transport to a trauma center, which, depending upon the defined trauma system, need not be the highest level trauma center.§§

No

Assess special patient or system considerations

Step Four

- Older adults¶¶
  - — Risk of injury/death increases after age 55 years
  - — SBP <110 might represent shock after age 65 years
  - — Low impact mechanisms (e.g. ground level falls) might result in severe injury
- Children
  - — Should be triaged preferentially to pediatric capable trauma centers
- Anticoagulants and bleeding disorders
  - — Patients with head injury are at high risk for rapid deterioration
- Burns
  - — Without other trauma mechanism: triage to burn facility***
  - — With trauma mechanism: triage to trauma center***
- Pregnancy > 20 weeks
- EMS provider judgment

Yes → Transport to a trauma center or hospital capable of timely and thorough evaluation and initial management of potentially serious injuries. Consider consultation with medical control.

No

Transport according to protocol†††

When in doubt, transport to a trauma center

Organisation of hospital admission

- Hospital and bed adapted to the patient severity
- Hospital management anticipation
- Patient transport organisation:
  - Ground or helicopter medical ICU?

SMUR vs non-SMUR management, is there a benefit in France ?

Table 1 Patients' characteristics and accident circumstances among patients with severe blunt trauma according to pre-hospital management

2703 injured patients

	Pre-hospital management		*P*-value
	Non-SMUR (*n* = 190); n (%)	SMUR (*n* = 2513); n (%)	
Sex			0.16
Male	153 (81%)	1,910 (76%)	
Female	37 (19%)	603 (24%)	
Age *			0.015
18 to 29 y	51 (27%)	915 (36%)	
30 to 54 y	82 (43%)	1,039 (41%)	
55 to 69 y	31 (16%)	338 (13%)	
≥70 y	26 (14%)	219 (9%)	
First hospital of admission			<0.001
General hospital	118 (62%)	533 (21%)	
University hospital	72 (38%)	1,980 (79%)	
Delay to hospital admission			
<1 h	88 (46%)	340 (14%)	
1 to 3 h	85 (45%)	1,845 (73%)	
≥3 h	17 (9%)	328 (13%)	
Delay to ICU admission			<0.001
<1 h	29 (16%)	168 (7%)	
1 to 3 h	33 (18%)	1,478 (61%)	
≥3 h	120 (66%)	777 (32%)	

Yeguiayan et al. Critical Care 2011, 15:R34
http://ccforum.com/content/15/1/R34

CRITICAL CARE

RESEARCH Open Access

Medical pre-hospital management reduces mortality in severe blunt trauma: a prospective epidemiological study

Jean-Michel Yeguiayan[1*], Delphine Garrigue[2], Christine Binquet[3], Claude Jacquot[4], Jacques Duranteau[5], Claude Martin[6], Fatima Rayeh[7], Bruno Riou[8], Claire Bonithon-Kopp[3], Marc Freysz[1], The FIRST (French Intensive Care Recorded In Severe Trauma) Study Group

Yeguiayan et al. Critical Care 2011

Risk of death at 30 days

	Odd Ratio	95% C.I.	P-value
Non-SMUR	1		
SMUR +	0,55	0,32 to 0,94	0,030

Medical pre-hospital management reduces mortality in severe blunt trauma: a prospective epidemiological study

Jean-Michel Yeguiayan[1*], Delphine Garrigue[2], Christine Binquet[3], Claude Jacquot[4], Jacques Duranteau[5], Claude Martin[6], Fatima Rayeh[7], Bruno Riou[8], Claire Bonithon-Kopp[3], Marc Freysz[1], The FIRST (French Intensive Care Recorded In Severe Trauma) Study Group

CRITICAL CARE

Yeguiayan *et al. Critical Care* 2011, **15**:R34
http://ccforum.com/content/15/1/R34

Table 4 Death rate before ICU discharge (within 30 days) according to pre-hospital management and selected characteristics (exclusion of 74 patients with cardiac arrest in the pre-hospital phase)

		Number of deaths (%) by pre-hospital management		
	Total	**Non-SMUR** *n* = 190	**SMUR** *n* = 2439	***P*-value**
GCS				
<8 (*n* = 775)	279 (36%)	10 (38%)	269 (36%)	0.79
8 to 13 (*n* = 566)	76 (13%)	7 (20%)	69 (13%)	0.30
≥14 (*n* = 1,213)	73 (6%)	10 (11%)	63 (6%)	0.032
Injury Severity Score				
<25 (*n* = 1,068)	61 (6%)	13 (12%)	48 (5%)	0.002
25 to 34 (*n* = 992)	192 (19%)	14 (20%)	178 (19%)	0.89
≥35 (*n* = 569	183 (32%)	2 (14%)	181 (33%)	0.24

Analysis performed among 2,629 patients without cardiac arrest during the pre-hospital phase. GCS, Glasgow Coma Scale; OR, odds ratio; SMUR, Service Mobile d'Urgences et de Réanimation.

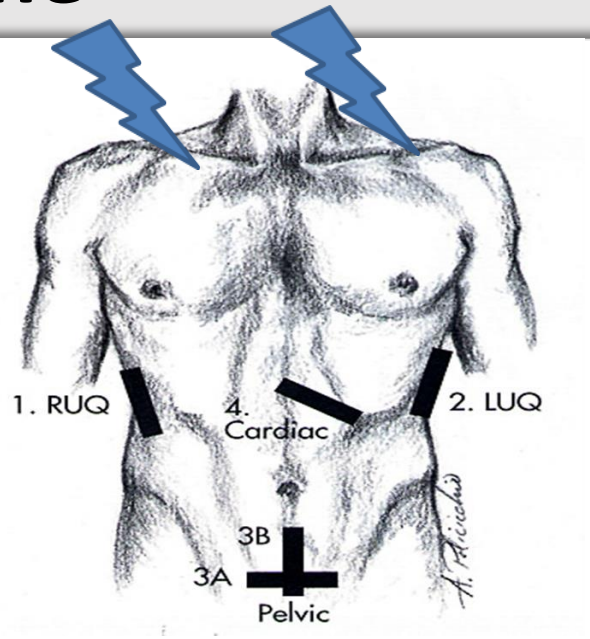
SMUR vs non-SMUR management, is there a benefit in France ?

Pre-hospital treatments

	All patients		By GCS* score		
	n/Nt	%	<8%	8 to 13%	>13%
Venous line	2,400/2,431	98.7	99.8	98.8	97.9
Crystalloids	1,690/2,386	70.8	72.4	69.1	70.6
Colloids	1,119/2,385	46.9	54.9	37.8	45.1
Mannitol	84/2,385	3.5	8.5	2.4	0.3
Catecholamines	284/2,456	11.6	22.1	8.7	5.2
Tracheal intubation	1,258/2,484	50.6	98.0	54.1	14.1
Mechanical ventilation	1,222/2,484	49.2	97.5	53.4	13.5
Blood products	81/2,463	3.3	3.7	3.1	2.8
Chest tube	45/2,450	1.8	2.0	1.5	1.7

FIRST Yeguiayan et al. Critical Care 2011

Medical triage at scene



FAST Lapostolle F et al Am J Emerg Med 2005

Transcranial Doppler Tazarourte K et al Acta AnaesthScand 2011

Procedures success

Exemple: prehospital orotracheal intubation success

Prehospital physicans

Auteur	*Année*	*n Patients*	*% Intubation difficile*	*% Intubation Impossible*
Orliaguet SAMU 75	1995	157	16	3
Cantineau SAMU 94	1997	224	4	0
Ricard SAMU 92	1997	147	5.4	0
Adnet Multicentric	1998	691	11	1

> 95%

Paramédics

Auteur	Taux de succès %	IC 95 %	Intubation / pers / an
BRADLEY 1998 B-EMT	49	36-62	0.60
SAYRE 1998 B-EMT	51	42-61	

~ 50% !

Prehospital intubation?

RESEARCH ARTICLE

Experience in Prehospital Endotracheal Intubation Significantly Influences Mortality of Patients with Severe Traumatic Brain Injury: A Systematic Review and Meta-Analysis

October 23, 2015

Sebastiaan M. Bossers[1], Lothar A. Schwarte[1,2], Stephan A. Loer[1], Jos W. R. Twisk[3],

Conclusions

Effects of prehospital endotracheal intubation depend on the experience of prehospital healthcare providers. Intubation by paramedics who are not well skilled to do so markedly increases mortality, suggesting that routine prehospital intubation of TBI patients should be abandoned in emergency medical services in which providers do not have ample training, skill and experience in performing this intervention.

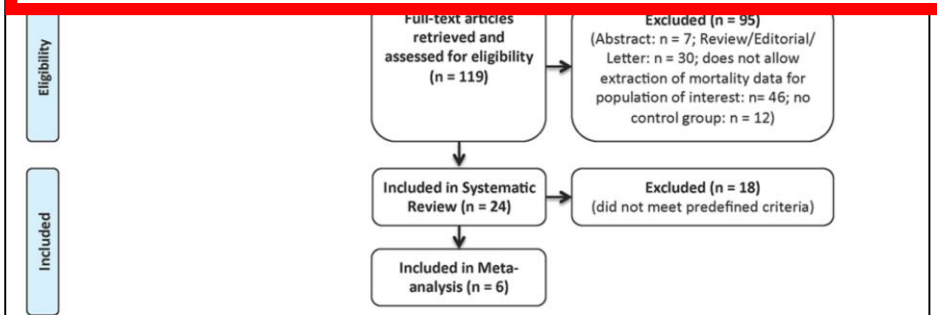
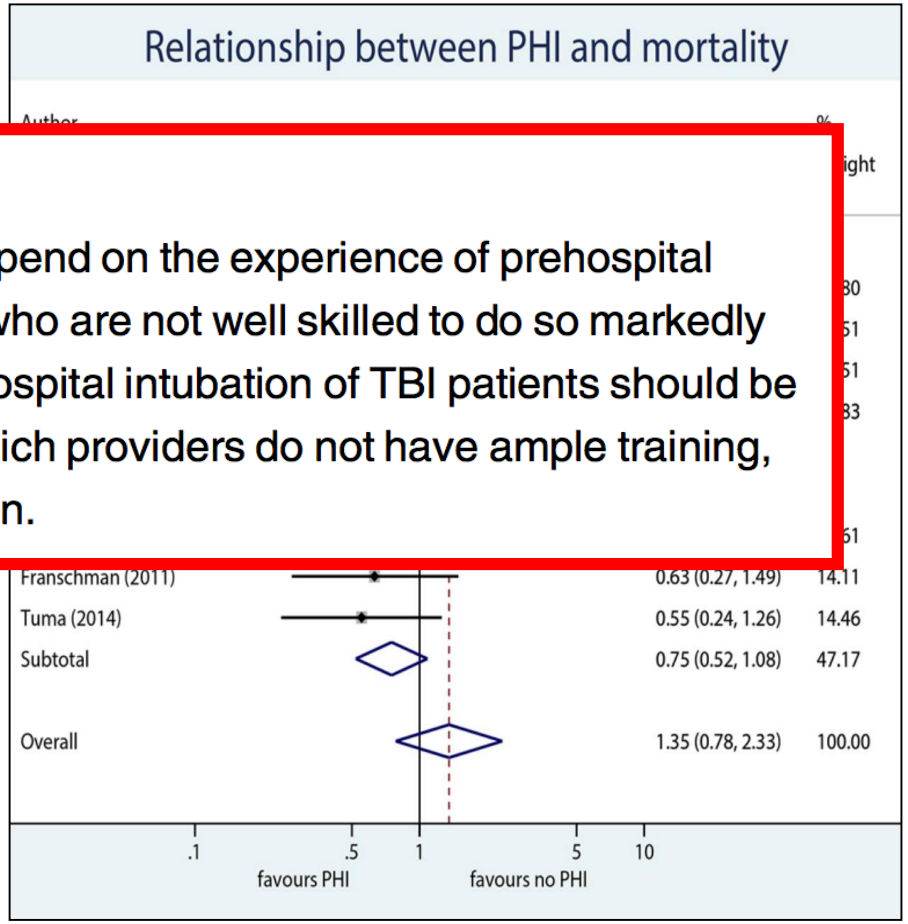
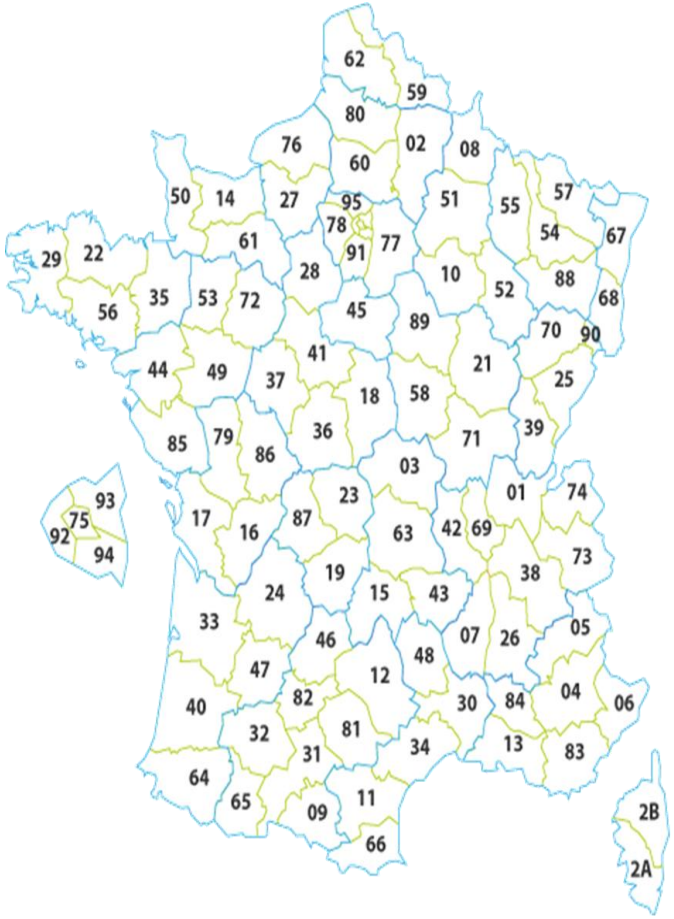


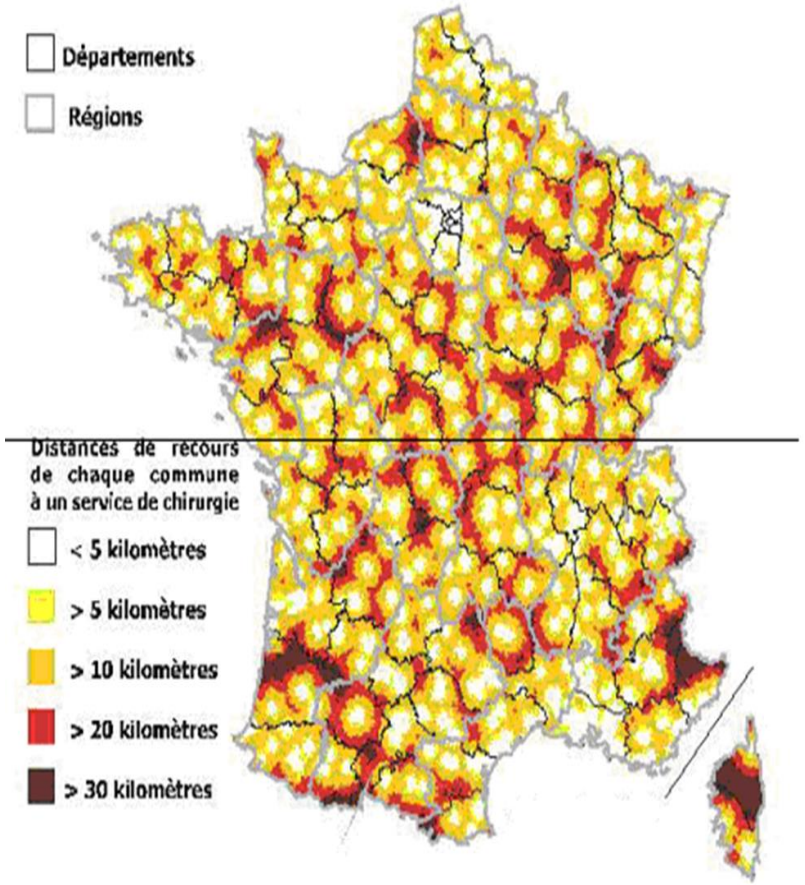
Fig 1. PRISMA flow diagram. PRISMA flow diagram summarizing identification, screening, eligibility and inclusion of studies.



French Trauma Organisation

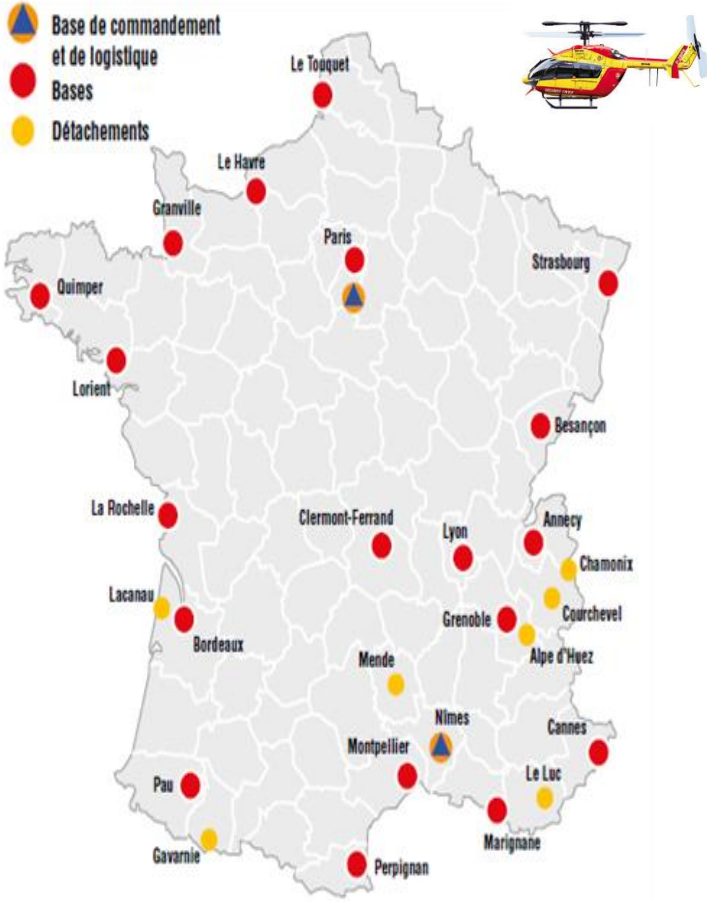


SAMU Localisation



Distance to Surgery Department

French health helicopters



In hospital based « SAMU/SMUR »

Civile defence helicopters

Impact of emergency medical helicopter transport directly to a university hospital trauma center on mortality of severe blunt trauma patients until discharge

Thibaut Desmettre[1*], Jean-Michel Yeguiayan[2], Hervé Coadou[3], Claude Jacquot[4], Mathieu Raux[5], Benoit Vivien[6], Claude Martin[7], Claire Bonithon-Kopp[8] and Marc Freysz[2], for the French Intensive Care Recorded in Severe Trauma

CRITICAL CARE

Desmettre *et al. Critical Care* 2012, **16**:R170
http://ccforum.com/content/16/5/R170

Table 3 Pre-hospital life-sustaining treatments according to mode of transport.

		Mode of Transport		
	all patients number (%) number = 1,958	**HMICU number (%) number = 516**	**GMICU number (%) number = 1,442**	***P***
Aggressive therapy[a]	287 (14.7)	97 (18.8)	190 (13.2)	0.002
(1)Tracheal intubation	1,050 (53.6)	308 (59.7)	742 (51.5)	0.001
(2) Colloids or SSH	1,074 (54.9)	238 (46.1)	836 (58.0)	<0.001
(3) Crystalloids ≥1000 ml	431 (22.0)	131 (25.4)	300 (20.8)	0.031
(4) Catecholamines	261 (13.3)	93 (18.0)	168 (11.7)	<0.001
(5) Blood products	72 (3.7)	43 (8.3)	29 (2.0)	<0.001
(6) Exsufflation or chest tube	38 (1.9)	14 (2.7)	24 (1.7)	0.14

[a]Aggressive therapy: if three or more of criteria (1) to (6) were present. GMICU, ground mobile intensive care unit; HMICU, helicopter mobile intensive care unit; SSH: hypertonic saline solution.

Prehospital« Overmanagment » for direct helicopter transport to the Trauma Center

Everyday Life... The Reality !

Paris aera and suburban TBI Study. 2011 - Tazarourte et al. Personnal Data

TIME	MINUTES [inter quartile range]
CALL TO SMUR ON SCENE	20 (12-40)
SMUR ON SCENE TO MEDICAL EVALUATION TRANSMISSION	34 (22-46)
MEDICAL EVALUATION TRANSMISSION TO DESTINATION NOTIFICATION	14 (8-23)
NOTIFICATION TO FIRST HOSPITAL ARRIVAL	41 (22-64)
TOTAL CALL THE SAMU-FIRST HOSPITAL	109 (85-149)

Under and Over Triage in Île de France

ORIGINAL ARTICLE

J Trauma Acute Care Surg. 2014

Evaluation of the performance of French physician-staffed emergency medical service in the triage of major trauma patients

Sophie Rym Hamada, MD, Tobias Gauss, MD, François-Xavier Duchateau, MD, Jennifer Truchot, MD, Anatole Harrois, MD, Mathieu Raux, MD, PHD, Jacques Duranteau, MD, PHD, Jean Mantz, MD, PHD, *and* Catherine Paugam-Burtz, MD, PHD, *Paris, France*

TABLE 2. Absolute and Rate of Adequate Triage, Overtriage, Undertriage, and Theoretical Triage for Main and Subgroup Analysis

	Cohort I, n = 825	Cohort II, n = 190
Adequate triage, n (%)	478 (58)	76 (41)
Overtriage, n (%)	346 (42)	108 (57)
Undertriage, n (%)	—	2 (<1)
Theoretical overtriage, n (%)	297 (36)	87 (46)
Theoretical undertriage, n (%)	16 (2)	2 (1)

Comparative Effectiveness of Inhospital Trauma Resuscitation at a French Trauma Center and Matched Patients Treated in the United States

Adil H. Haider, MD, MPH, FACS, Jean-Stephane David, MD, PhD,†‡ Syed Nabeel Zafar, MBBS, MPH,‡‡ Pierre-Yves Gueugniaud, MD, PhD,§ David T. Efron, MD,* Bernard Floccard, MD,¶ Ellen J. MacKenzie, PhD,|| and Eric Voiglio, MD, PhD, FACS, FRCS**††*

Ann Surg 2013

	Mortality Rate			
	Lyon	NTDB	OR	95% CI
All	13.7%	13.5%	1.0	0.77–1.39
Blunt injury	14.5%	14.4%	1.0	0.75–1.37
Penetrating injury	5.3%	4.2%	1.9	0.41–8.59
GCS 3–8	47.4%	43.8%	1.4	0.91–2.07
GCS 9–15	3.9%	4.8%	0.7	0.47–1.19

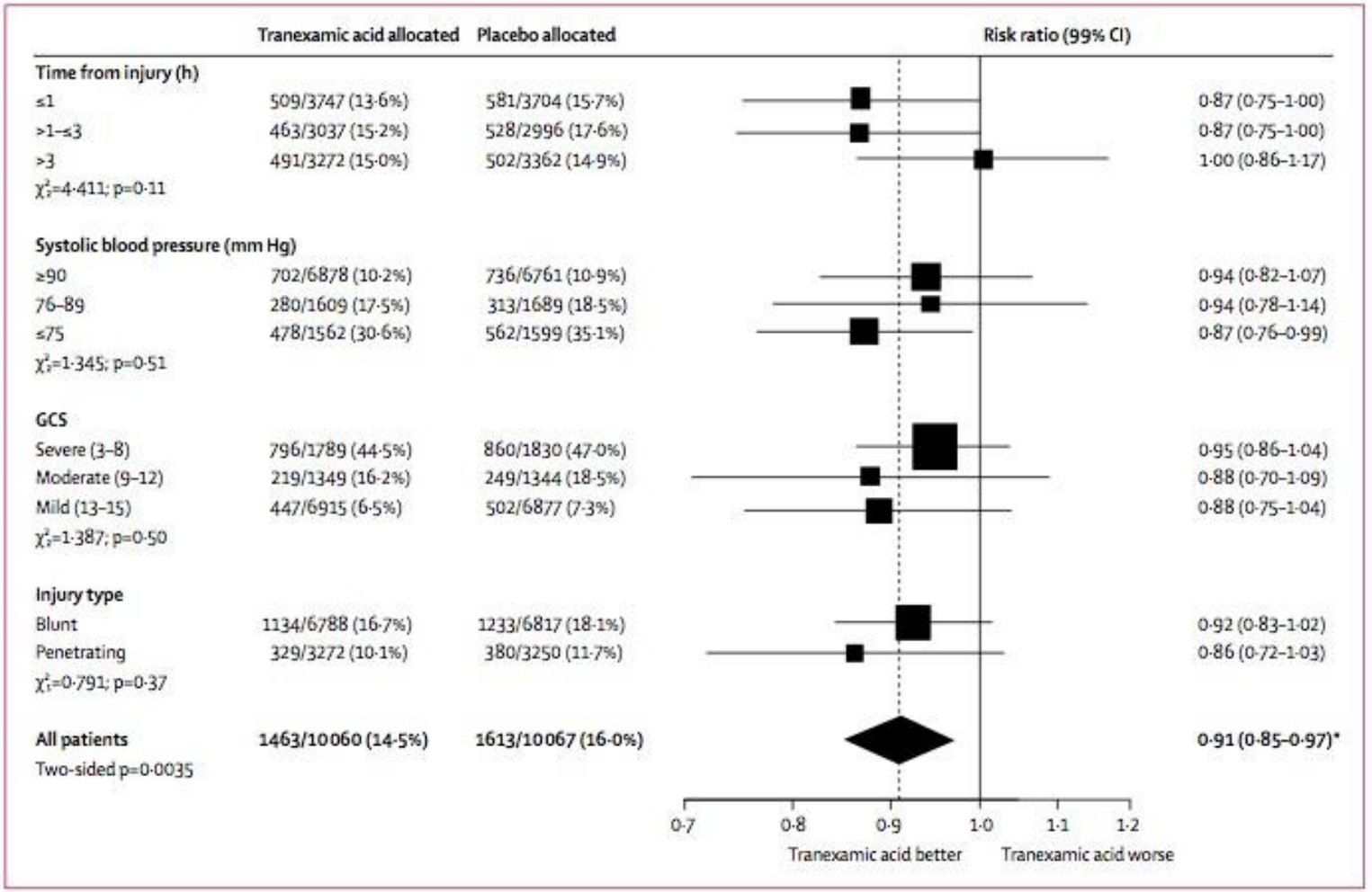
Volume loading Adjuvants blood management

- Transfusion / autotransfusion
- Hémostasis and coagulation correction
- Acidosis and hypocalcemia Correction
- Rewarming
- Hemostasis surgery

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**

(CRASH-2, *Lancet* 2010)



Take home message

- Care organisation
- Importance of training

Conclusion

- The best approach for prehospital management is the one which saves lives
- « Good trauma care depends on getting the Right patient, to the Right place at the Right time »
- Writen procedures, formation, pratice and training = the keys for success
- There is not an universal system but instead an adapted system at the country ressources
- We believe that a doctor in prehospital setting and a trauma network are of great interest

Thank you for your attention

Helicopter transport improves survival following injury in the absence of a time-saving advantage

155,691 HEMS/GEMS pairs matched. Retrospective cohort of scene HEMS and GEMS transports in the US National Trauma Databank (2007-2012). Propensity score matching was used to match HEMS and GEMS subjects

“ **HEMS had a survival benefit over GEMS for prehospital transport times between 6 and 30 minutes**…**This prehospital transport times window corresponds to estimated transport distance between 14.3 and 71.3 miles for HEMS and 3.3 and 16.6 miles for GEMS**”.

JB Brown , Surgery 2016

Mechanism, Glasgow Coma Scale, Age, and Arterial Pressure (MGAP): A new simple prehospital triage score to predict mortality in trauma patients*

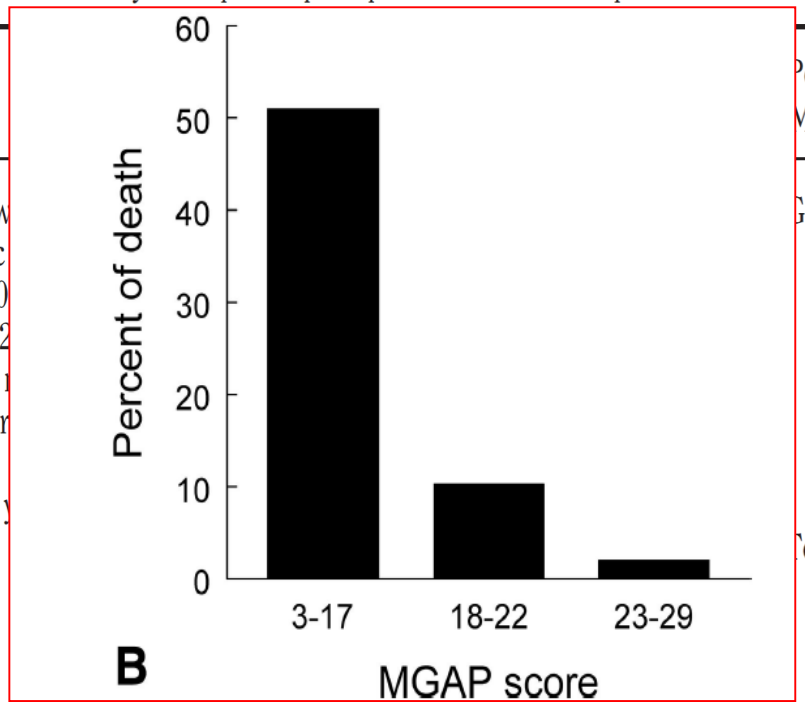
Danielle Sartorius, MD; Yannick Le Manach, MD; Jean-Stéphane David, MD, PhD; Elisabeth Rancurel, MD; Nadia Smail, MD; Michel Thicoïpé, MD; Eric Wiel, MD, PhD; Agnès Ricard-Hibon, MD, PhD; Frédéric Berthier, MD; Pierre-Yves Gueugniaud, MD, PhD; Bruno Riou, MD, PhD

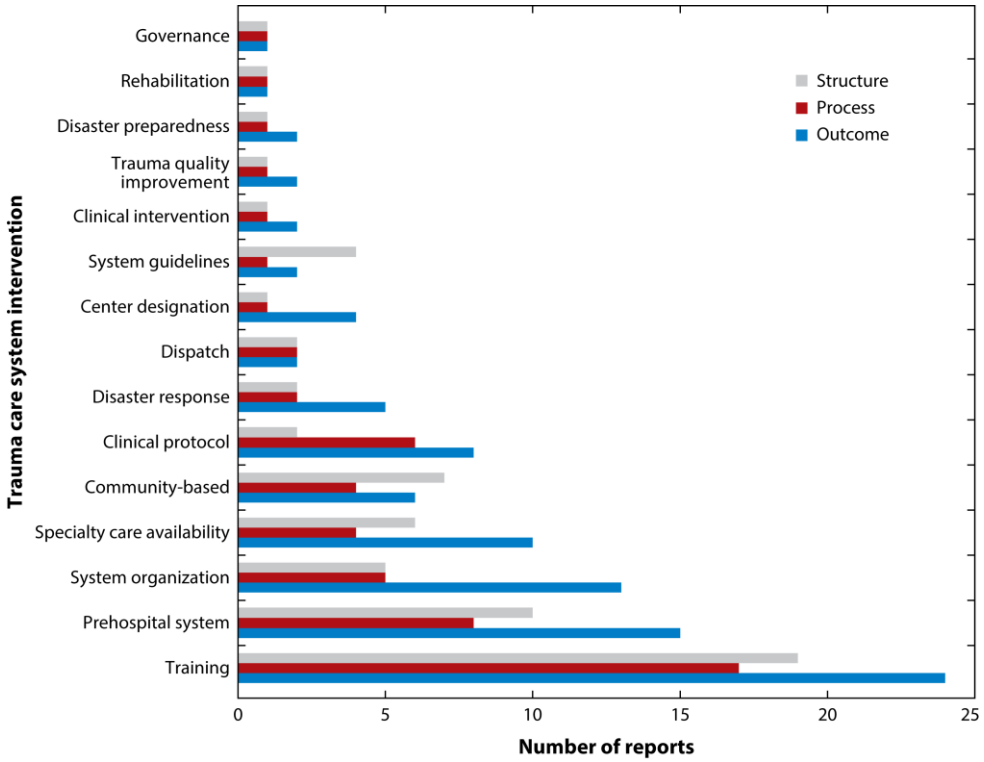
Critical Care Med. 2010

Multivariate analysis of prehospital predictors of in-hospital death

		Points of the MGAP Score
Glasgow		GCS value
Systolic		
	>120	+5
	60–12	+3
	<60	0
Blunt tr		+4
Age		+5
	<60 y	

Total: 3 to 29





Reynolds TA, et al. 2017.
Annu. Rev. Public Health. 38:507–32

Annual Reviews