Risk Stratification and Outcome Measures

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- TraumaRegister DGU®
- DIVI Intensive Care Registry
- German Resuscitation Registry
- Thorax Registry
- German Burn Registry
- National Emergency Room Registry
- ....

EuReCa

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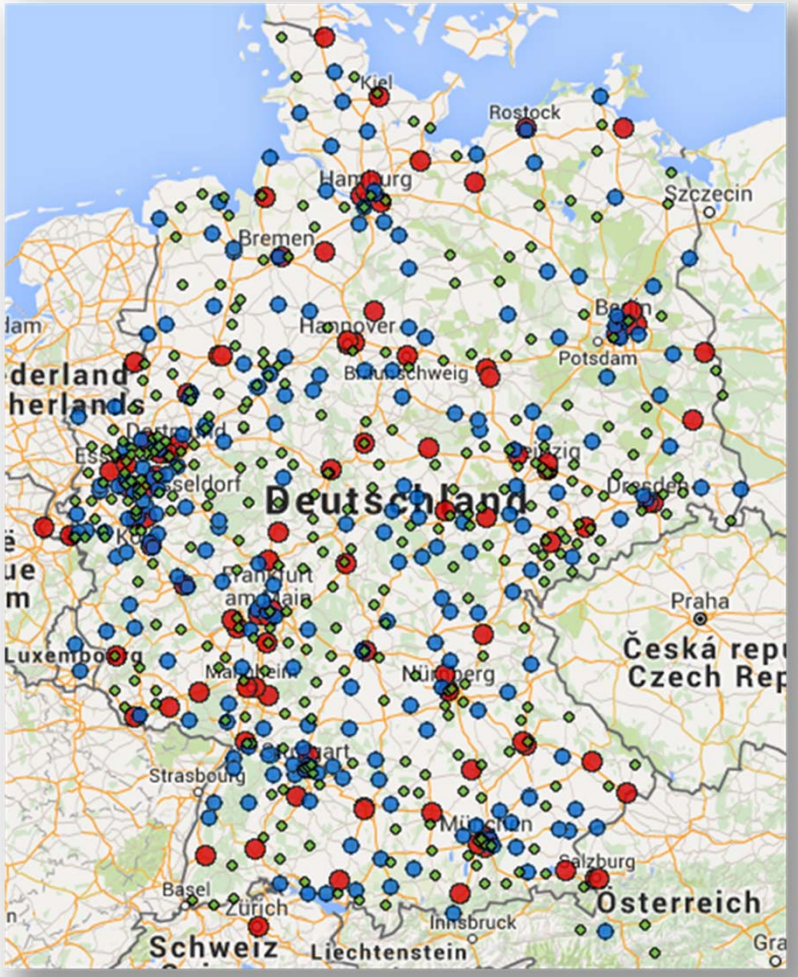
TRAUMA® REGISTER

DEUTSCHE GESELLSCHAFT FÜR UNFALLCHIRURGIE



- founded in 1993 (25)
- started with 5 hospitals
- 650 German hospitals
- 3 levels of care
- 30 international hospitals
- inclusion: intensive care
- 35.000 cases per year
- annual reports
- 30 paper / year
- Owner: society

Aims:

1. Quality Assessment / Comparison
2. Scientific Analyses

Primary Outcome:

Survival

Problem:

Lack of comparability (large vs. small hospitals; severity; ...)

Statistical Methods for Adjustment

- Selection
- Subgroup analyses
- Matched-Pairs
- Outcome Adjustment
- Propensity Score

Lefering R. Strategies for comparative analyses of registry data. *Injury* 2014, Suppl. 45S: S83-S88

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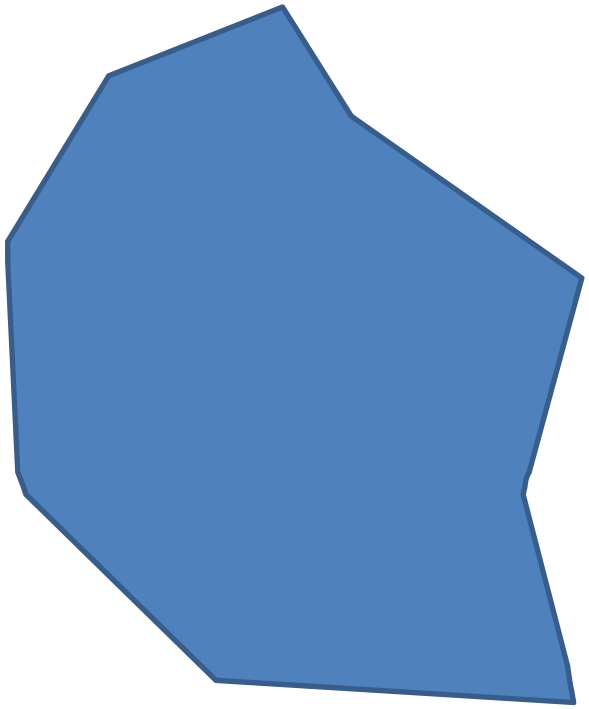
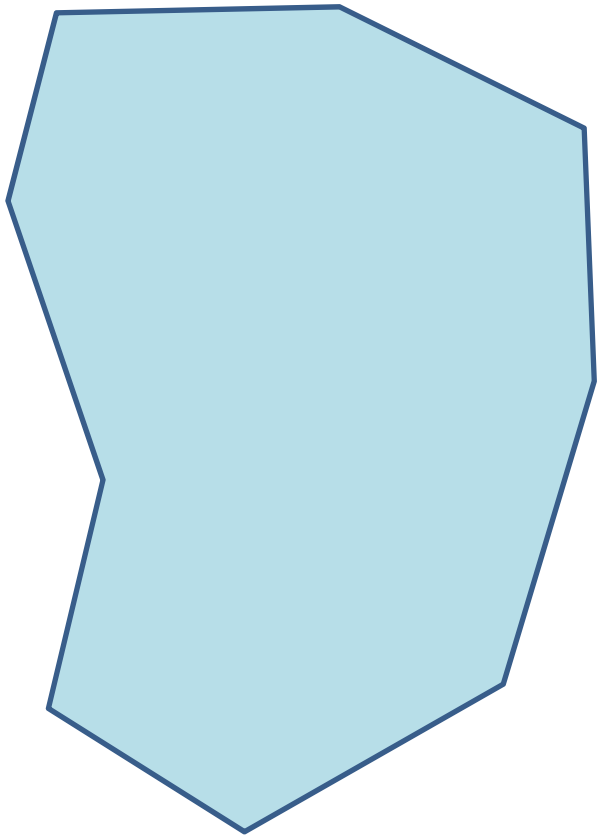
Group 1



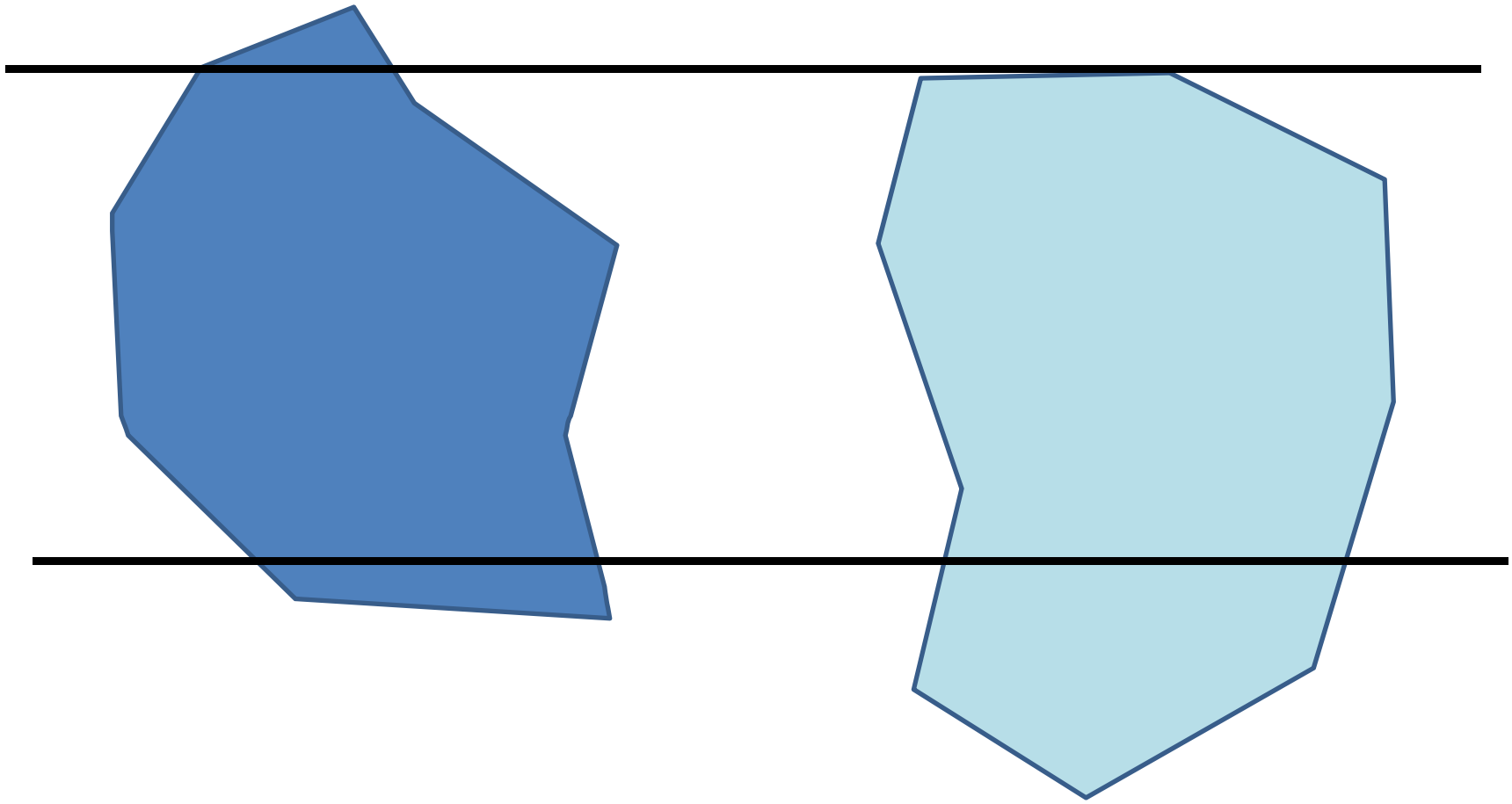
Group 2



Selection

Group 1

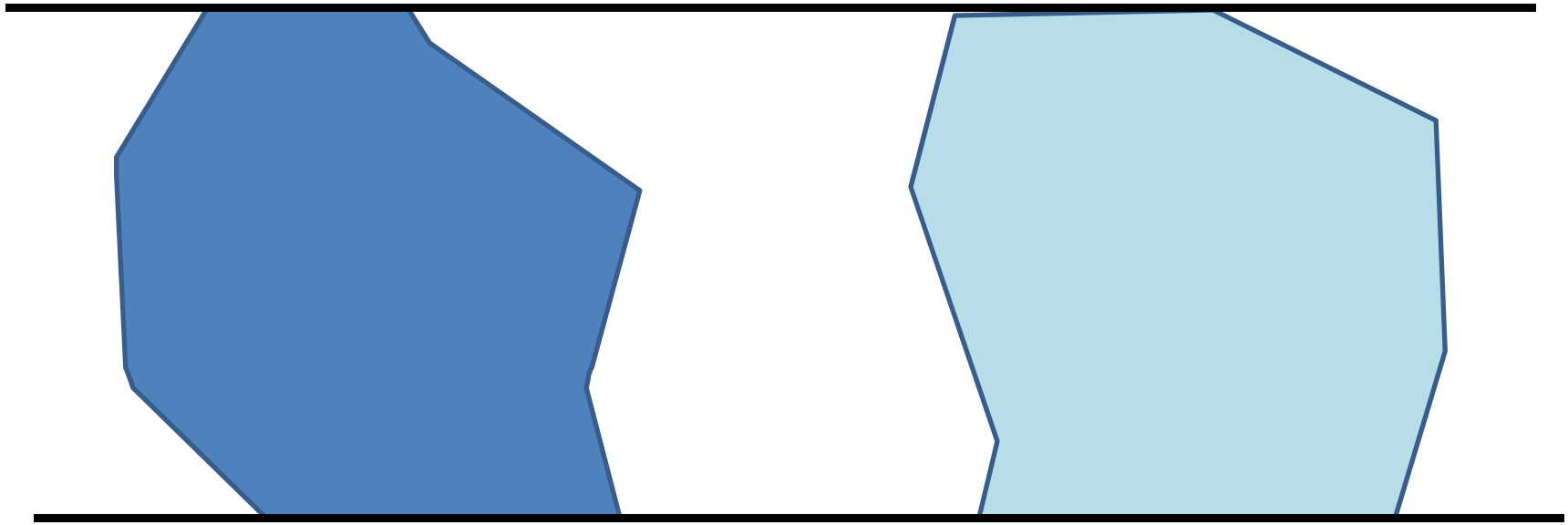
Group 2



Selection

Group 1

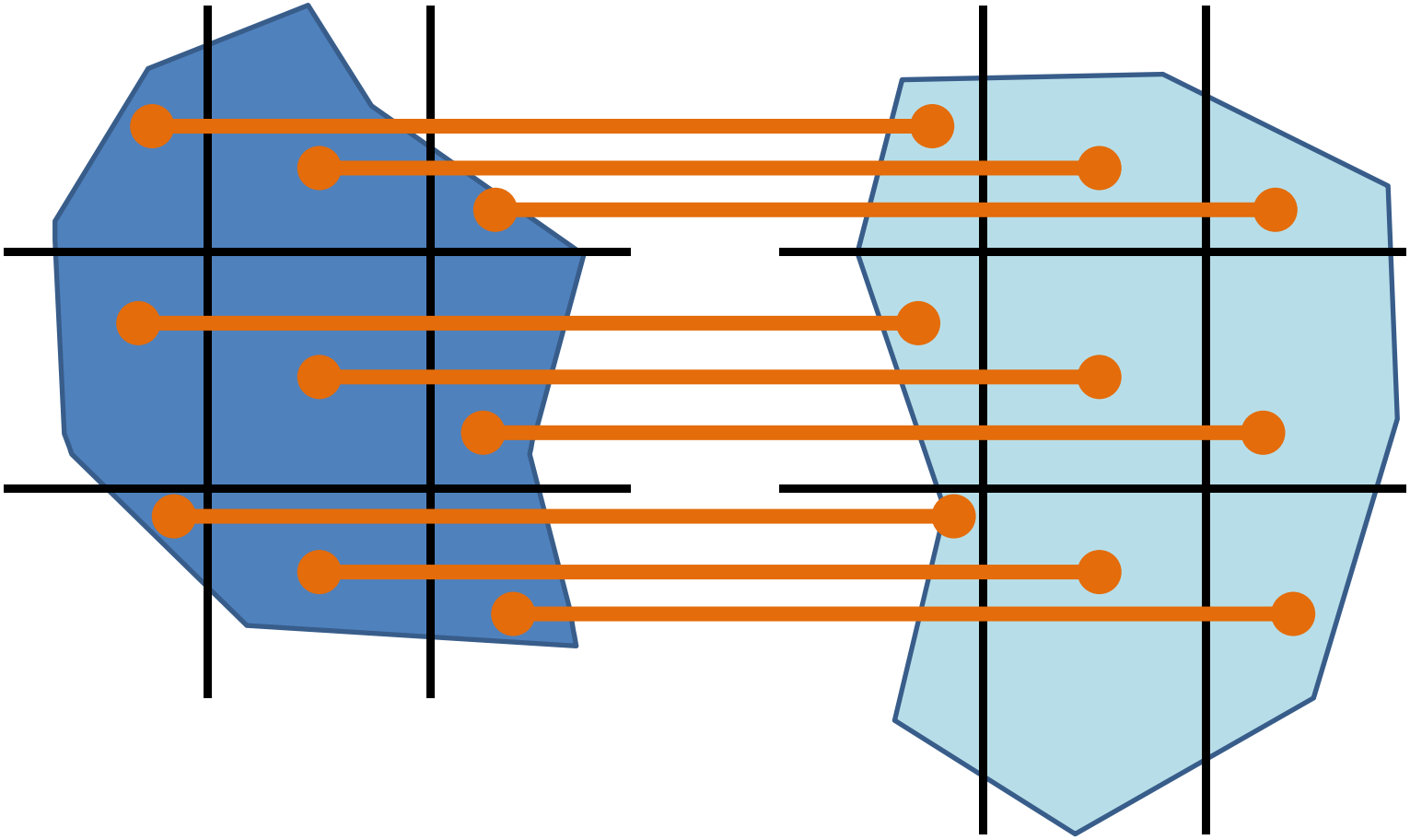
Group 2



Subgroups

Group 1

Group 2



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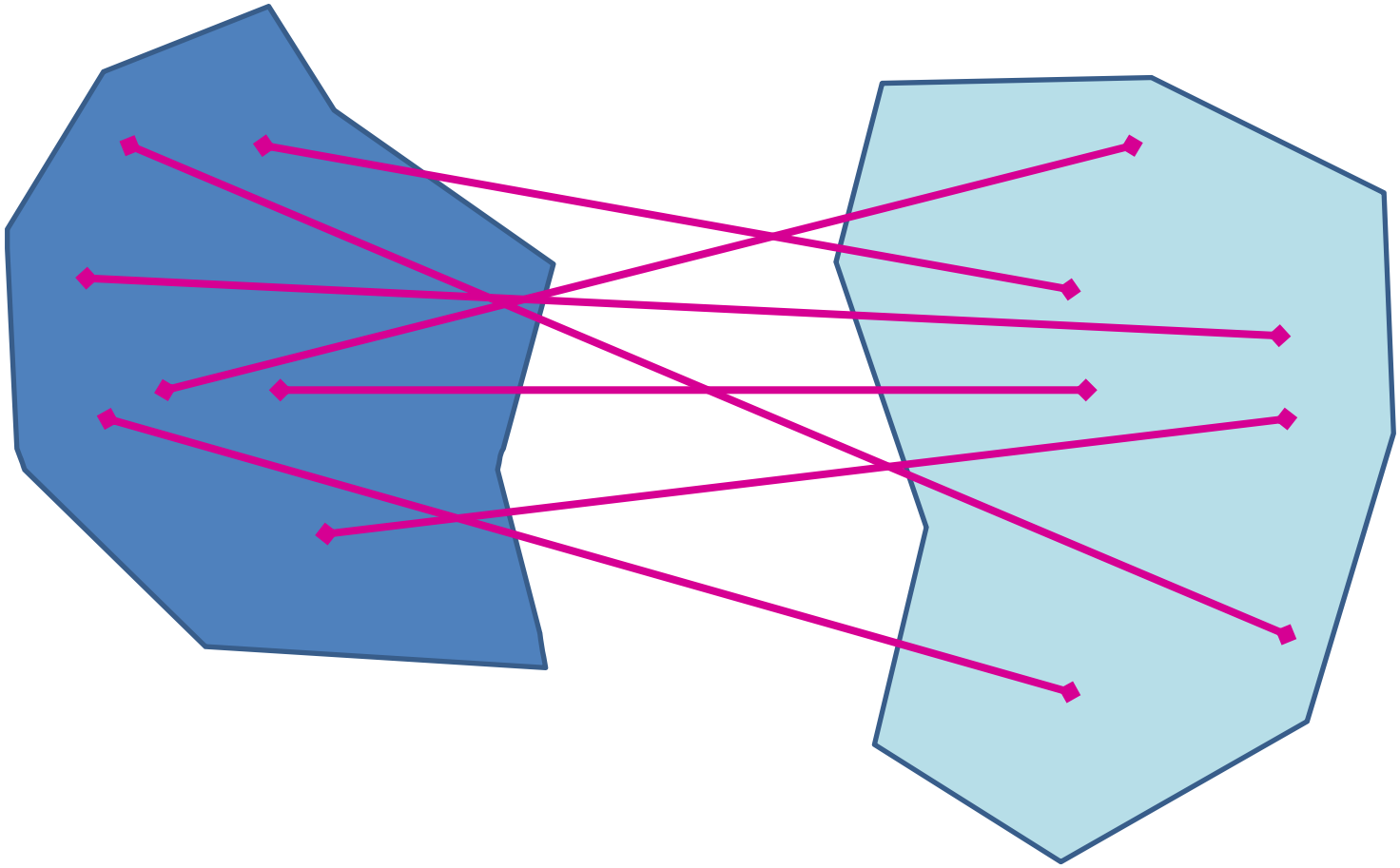
Matched-Pairs

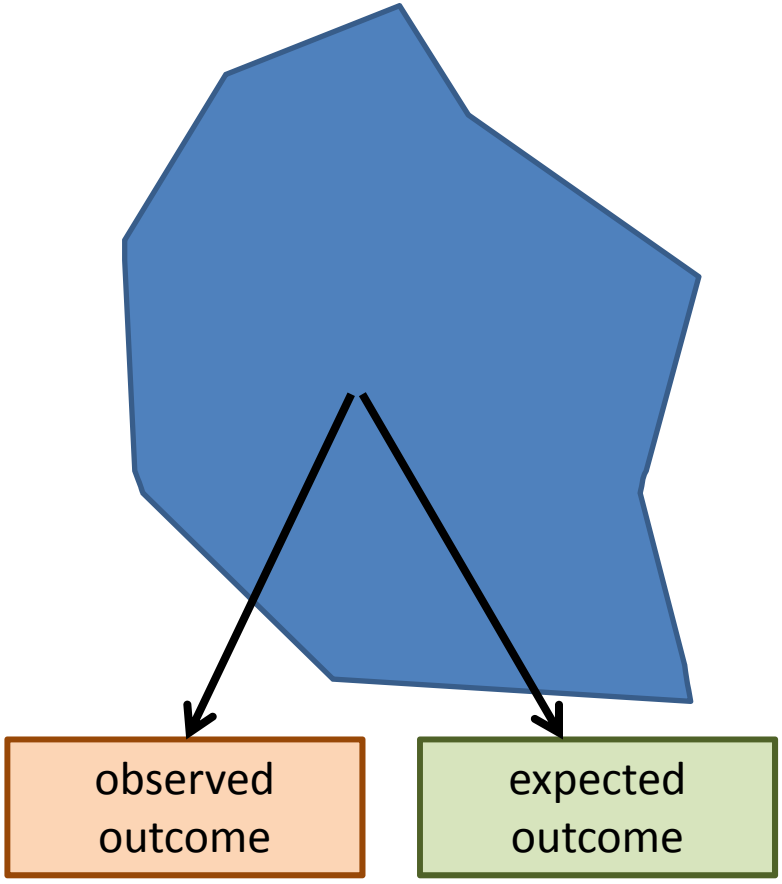
Group 1

Group 2

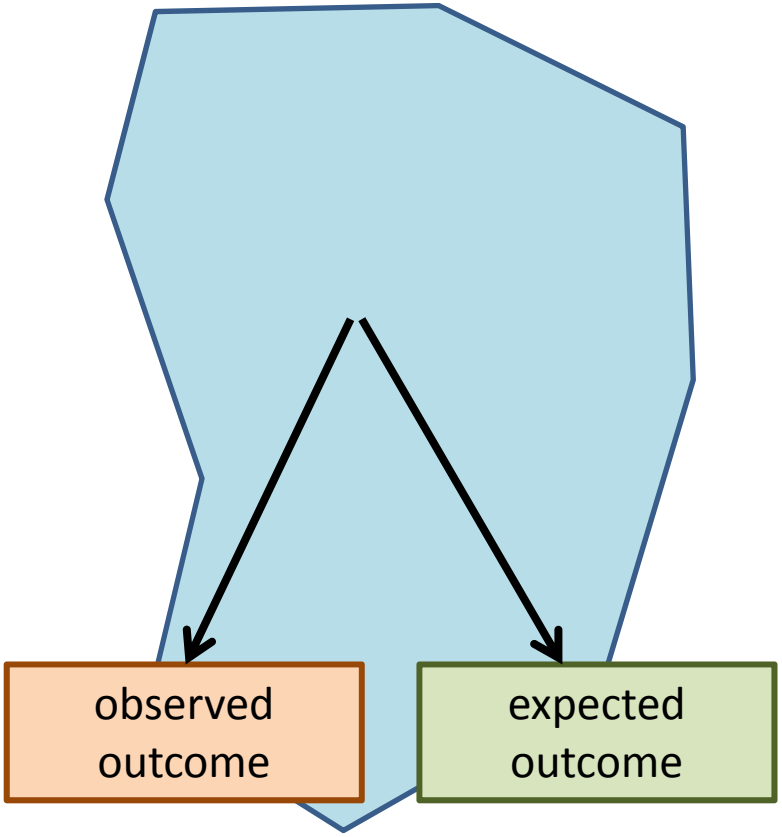


Adjusted Outcome

Group 1



Group 2



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Outcome Adjustment

- Select the **outcome** of interest

  (survival, ROSC, good neurology, LOS, return to work, ...)

- Identify **confounder** or **prognostic factors**

  (= factors influencing the outcome)

  - patient (age, sex, prior diseases, ...)
  - severity (injuries, rhythm, ...)
  - surroundings (day/night, location, ...)
  - activities (bystander CPR, ...)
  - time intervals

- **Combine** these factors adequately

  - multivariate statistics
  - scores

Severe Trauma

ISS	Injury Severity Score (1974): anatomical severity
RTS	Revised Trauma Score (1989): physiology
TRISS	ISS + RTS + age (1990)
RISC	Revised Injury Severity Classification (2003) based on 2000 TR-DGU patients
RISC II	Update 2013; based on 30,000 TR-DGU patients 13 predictors

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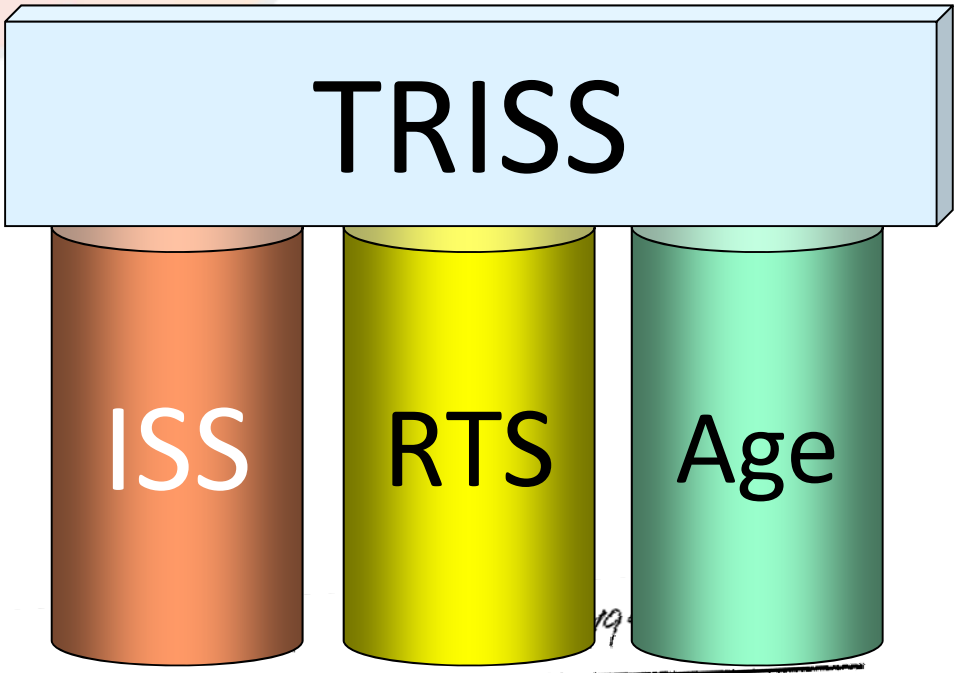

THE JOURNAL OF TRAUMA

The Major Trauma Outcome Study: Establishing National Norms for Trauma Care

HOWARD R. CHAMPION, F.R.C.S. (EDIN.), F.A.C.S., WAYNE S. COPES, PH.D., WILLIAM J. SACCO, PH.D., MARY M. LAWNICK, R.N., B.S.N., SUSAN L. KEAST, R.N., B.S.N., LAWRENCE W. BAIN, JR., MAUREEN E. FLANAGAN, M.S., AND CHARLES F. FREY, M.D., F.A.C.S.*

The Major Trauma Outcome Study (MTOS) is a retrospective descriptive study of injury severity and outcome coordinated through the American College of Surgeons' Committee on Trauma. From 1982 through 1987, 139 North American hospitals submitted demographic, etiologic, injury severity, Motor vehicle related injuries

RISC II

Variable	Value	Coefficient
Constant		+ 3.6
Worst injury	AIS 3	- 0.5
	AIS 4	- 1.3
	AIS 5	- 1.7
	AIS 6	- 2.9
Second worst injury	AIS 0-2	+ 0.2
	AIS 3	0
	AIS 4	- 0.6
	AIS 5	- 1.4
Head injury	AIS 0-2	0
	AIS 3/4	- 0.2
	AIS 5/6	- 0.8
Age	1-5	+ 1.4
	6-10	+ 0.6
	11-54	0
	55-59	- 0.5
	60-64	- 0.8
	65-69	- 0.9
	70-74	- 1.2
	75-79	- 1.9
	80-84	- 2.4
	85+	- 2.7
Pupil reactivity	brisk	+ 0.2
	sluggish/???	0
	fixed	- 1.0
Pupil size	normal	+ 0.2
	anisocoric/???	0
	bilat. dilated	- 0.5

Variable	Value	Coefficient
Sex	female	+ 0.2
	male / ???	0
ASA pre-trauma	1-2	+ 0.3
	3 / ???	0
	4	- 1.3
Mechanism	blunt / ???	0
	penetrating	- 0.6
GCS motor function	normal	+ 0.6
	directed / ???	0
	non-directed	- 0.4
	none	- 0.8
Systolic BP on admission	< 90	- 0.7
	90-110 / ???	0
	111-150	+ 0.3
	> 150	0
CPR	nein / ???	0
	ja	- 1.8
Coagulation: INR	< 1.2	+ 0.6
	1.2 - <1.4	+ 0.2
	1.4 - 2.4 / ???	0
	> 2.4	- 0.4
Blood: Hemoglobin	≥ 12.0	+ 0.4
	7.0-11.9 / ???	0
	<7.0	- 0.5
Acidosis: Base deficit	< 6	+0.3
	6-9 / ???	0
	9-15	- 0.4
	15+	- 1.5

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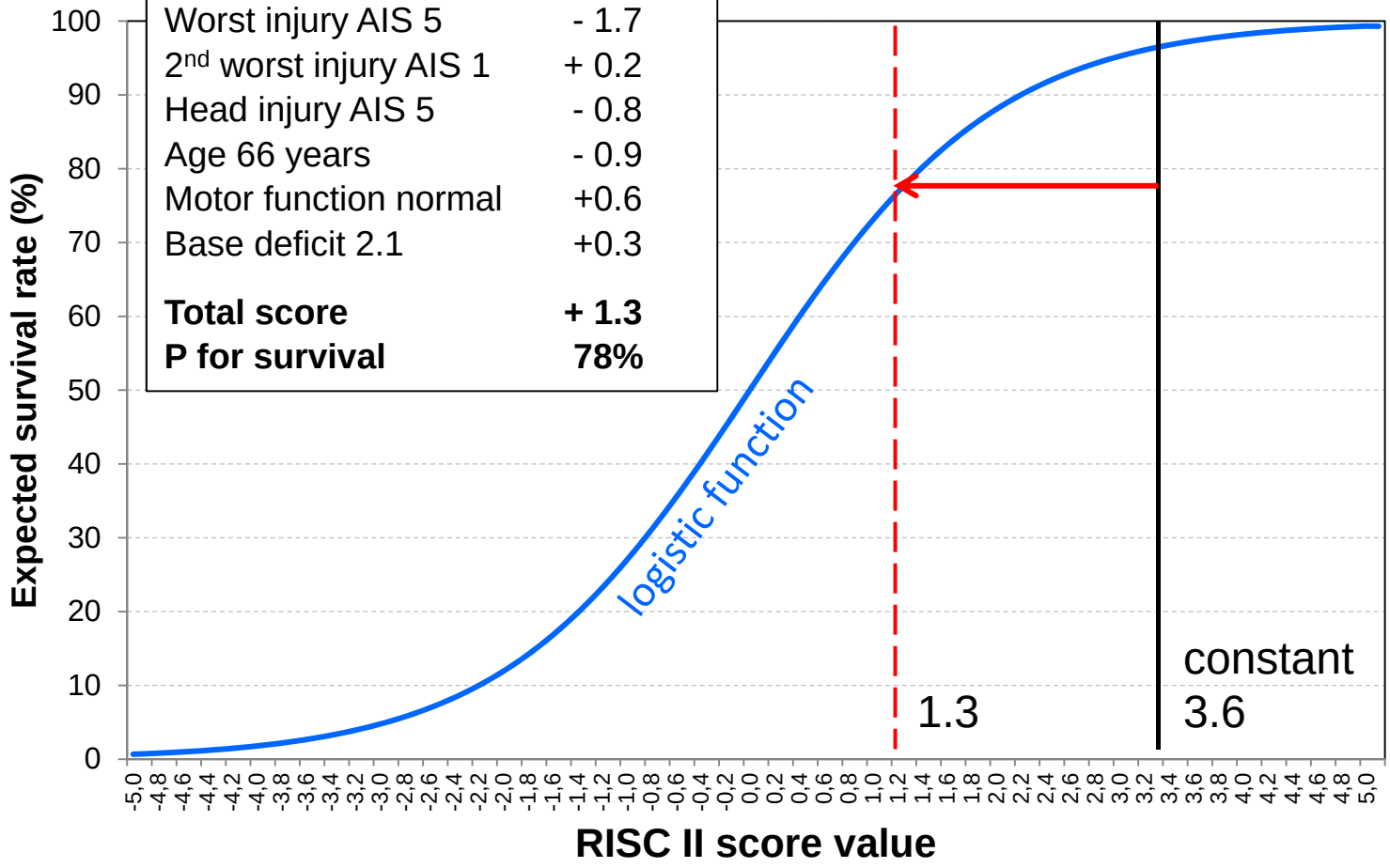
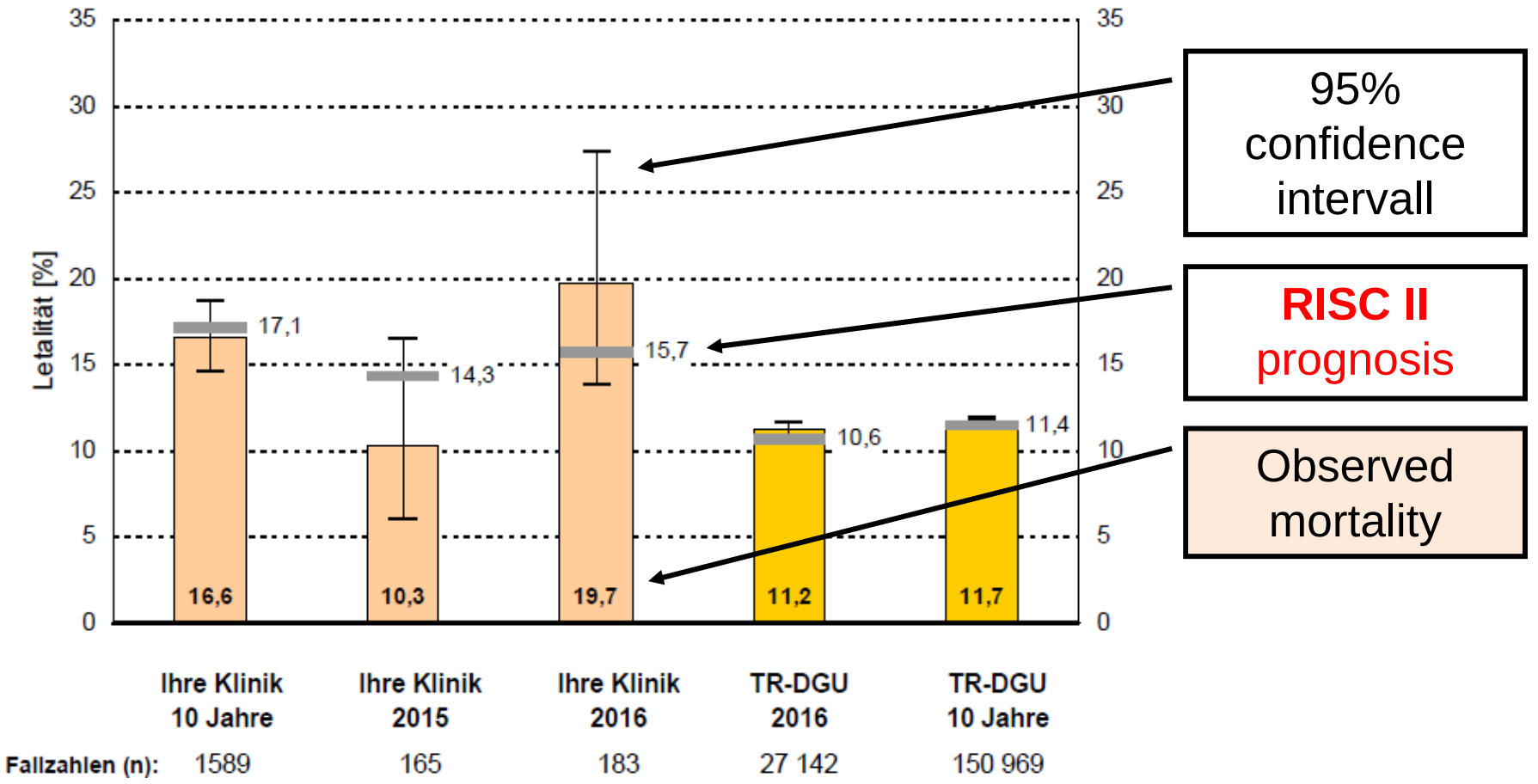
RISC II

66 y. old man with isolated severe head injury, normal GCS

Constant	3.6
Worst injury AIS 5	- 1.7
2nd worst injury AIS 1	+ 0.2
Head injury AIS 5	- 0.8
Age 66 years	- 0.9
Motor function normal	+0.6
Base deficit 2.1	+0.3
Total score	**+ 1.3**
P for survival	**78%**



Observed Mortality vs. RISC II Prognosis



RISC II = Revised Injury Severity Classification, version II

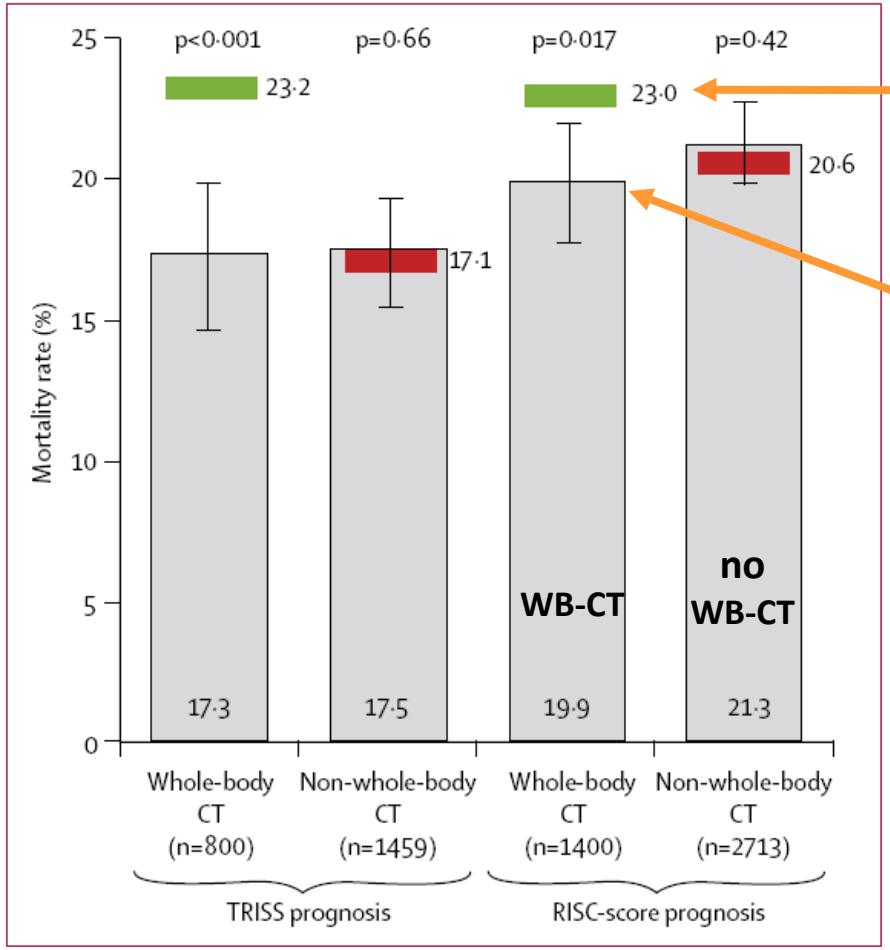
Effect of

whole-body CT

during trauma

resuscitation

on survival



RISC Prognosis

Mortality

Huber-Wagner, Lefering, et al. „Effect of whole-body CT during trauma resuscitation on survival: a retrospective multicentre study" *Lancet* 2009

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Out of Hospital Cardiac Arrest

	Trauma	OHCA
Patients	Range of severity	single event: CA with CPR
Outcomes	Survival	ROSC Survival Good neurology
Setting	Pre-hospital **Hospital**	**Pre-hospital** Hospital
Incidence	**40** /100,000 /year	**60** /100,000 /year

CPR

Cardio-Pulmonary Resuscitation after Trauma

Gräsner *et al. Critical Care* 2011, **15**:R276
http://ccforum.com/content/15/6/R276

CRITICAL CARE

RESEARCH Open Access

Cardiopulmonary resuscitation traumatic cardiac arrest - there are survivors.An analysis of two national emergency registries

Jan-Thorsten Gräsner[1*], Jan Wnent[2], Stephan Seewald[1], Patrick Meybohm[1], Matthias Fischer[3], Thomas Paffrath[4], Arasch Wafaisade[4], Berthold Bein[1] and Rolf Lefering[5], for
German Resuscitation Registry Working Group, Trauma Registry of the German Society for Trauma Surgery (DGU)

Gräsner JT, Wnent J, Seewald S, Meybohm P, Fischer M, Paffrath T, Wafaisade A, Bein B, Lefering R.
Cardiopulmonary resuscitation after traumatic cardiac arrest – there are survivors.
An analysis of two national emergency registries. *Crit Care* 2011, 15: R276

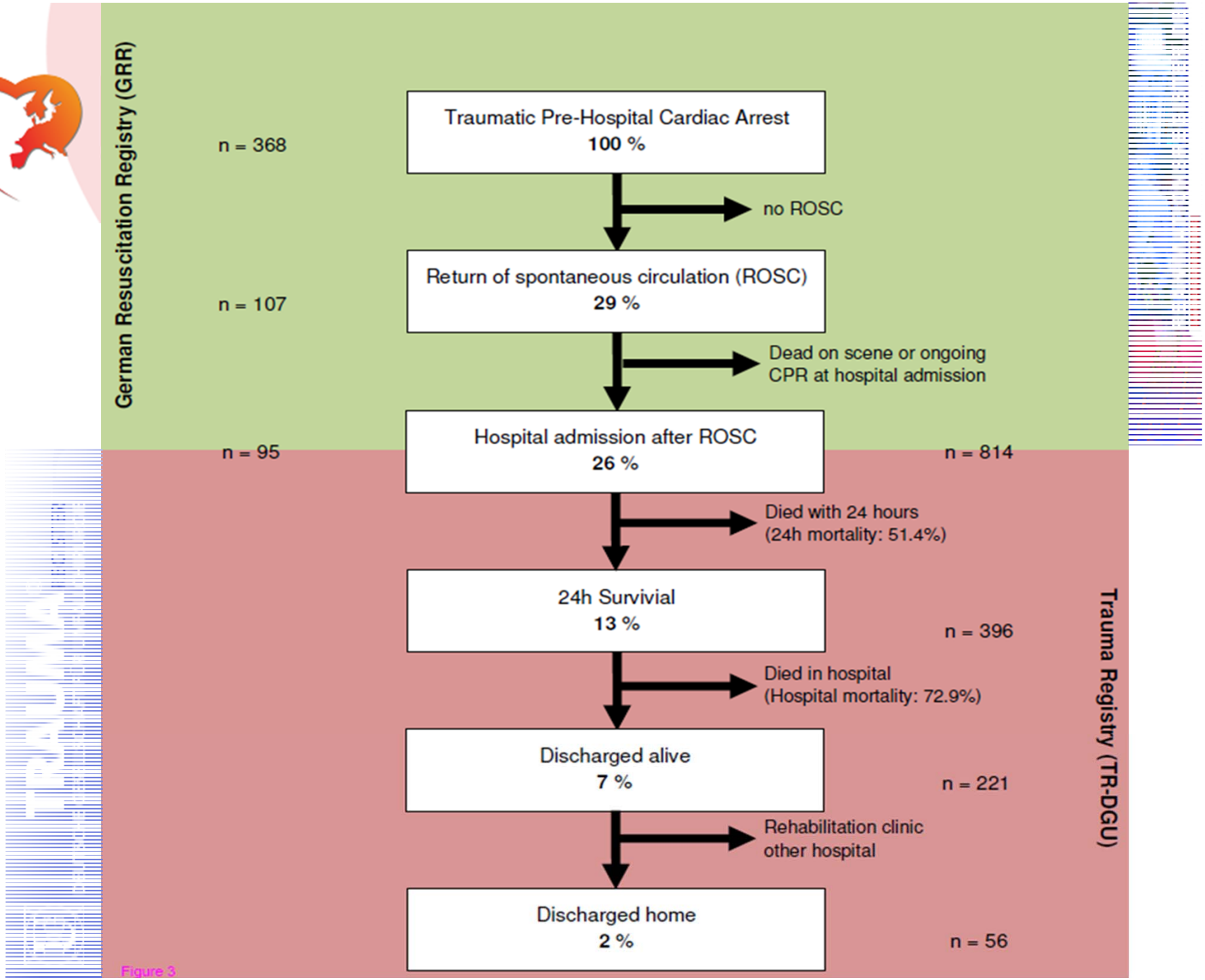
German Resuscitation Registry (GRR)
Trauma Registry (TR-DGU)
n = 368
Traumatic Pre-Hospital Cardiac Arrest
100 %
no ROSC
n = 107
Return of spontaneous circulation (ROSC)
29 %
Dead on scene or ongoing
CPR at hospital admission
n = 95
Hospital admission after ROSC
26 %
n = 814
Died with 24 hours
(24h mortality: 51.4%)
24h Survivial
13 %
n = 396
Died in hospital
(Hospital mortality: 72.9%)
Discharged alive
7 %
n = 221
Rehabilitation clinic
other hospital
Discharged home
2 %
n = 56

Figure 3

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European Heart Journal
doi:10.1093/eurheartj/ehr107

CLINICAL RESEARCH

ROSC after cardiac arrest—the RACA score to predict outcome after out-of-hospital cardiac arrest

Jan-Thorsten Gräsner[1]*†, Patrick Meybohm[1]†, Rolf Lefering[2], Jan Wnent[1], Jan Bahr[3], Martin Messelken[4], Tanja Jantzen[5], Rüdiger Franz[6], Jens Scholz[1], Alexander Schleppers[7], Bernd W. Böttiger[8], Berthold Bein[1], and Matthias Fischer[9], the German Resuscitation Registry S...

[1]Department of Anaesthesiology and Intensive Care Medicine, University Hospital Schles... Kiel, Germany; [2]Faculty of Health, Institute for Research in Operative Medicine, University Witten/Herdecke, Köl... ...ergency and Intensive Care Medicine, University Medical Centre, University of Goettingen, Goettin... ...tensive Care, Klinikum am Eichert, Göppingen, Germany; [5]Interhospital-Transfer-Service Mecklenburg-Vorpommer... ...epartment of Anaesthesiology and Intensive Care Medicine, St-Marien-Hospital, Lünen, Germany; [7]German Society of Anaesthe... ...cine, Nürnberg, Germany; [8]Department of Anaesthesiology and Postoperative Intensive Care Medicine, University Hospital, Köln, Germany; and [9]... ...aesthesiology and Intensive Care (DGAI), Klinik am Eichert, Göppingen, Germany

RACA - ROSC After Cardiac Arrest

Received 21 October 2010; revised 10 March 2011; accepted 20 March 2011

Prediction of ROSC
in OHCA patients
in Germany

- n = 5471
- ROSC rate 43%
- logistic regression
- validation

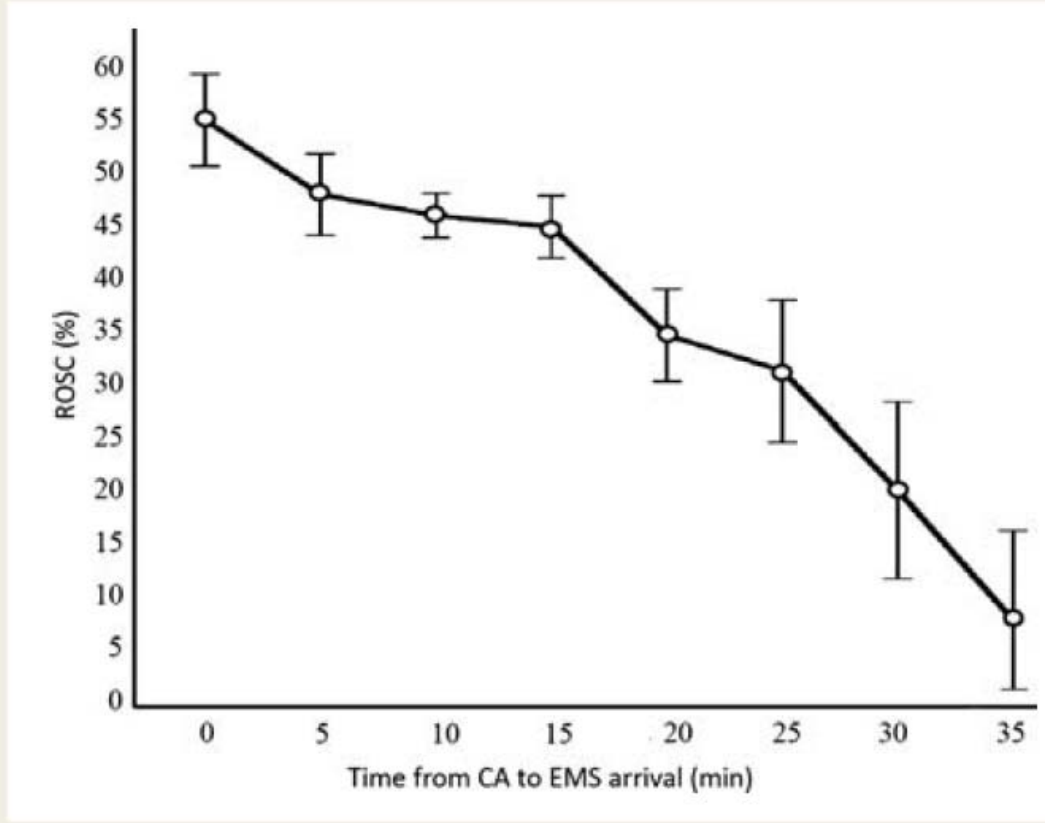

Table 2 Results of multivariate logistic regression analysis

Variable	Condition	Regression coefficient	SE	*P*-values	OR (95% CI)
Sex	Male	−0.17	0.54	0.01	0.85 (0.75–0.96)
Age	≥80 years	−0.19	0.08	0.02	0.83 (0.72–0.97)
Aetiology	Trauma	−0.56	0.21	0.01	0.57 (0.38–0.85)
	Hypoxia	+0.68	0.12	<0.001	1.98 (1.57–2.48)
	Intoxication	+0.45	0.22	0.04	1.57 (1.02–2.40)
Witnessed	Lay people	+0.62	0.07	<0.001	1.86 (1.64–2.12)
	Professional	+0.49	0.11	<0.001	1.63 (1.31–2.02)
Location at	Nursing home	−0.27	0.16	0.079	0.76 (0.56–1.03)
	Doctor's office	+1.17	0.26	<0.001	3.23 (1.93–5.40)
	Public place	+0.34	0.08	<0.001	1.40 (1.20–1.64)
	Medical institution	+0.52	0.22	0.016	1.69 (1.10–2.58)
Initial ECG	PEA	−0.82	0.1	<0.001	0.44 (0.36–0.53)
	Asystole	−1.08	0.65	<0.001	0.34 (0.30–0.39)
Bystander CPR	Yes	+0.23	0.09	0.008	1.26 (1.06–1.49)
EMS arrival time	Per minute	−0.04	0.01	<0.001	0.96 (0.95–0.97)
Constant		0.29	0.09	0.001	1.34

Multivariate logistic regression analysis was performed to investigate the influence of different variables on chance of return of spontaneous circulation (ROSC). Independent variables that were associated with a positive coefficient increase the chance of ROSC, while negative coefficients decrease the chance of ROSC. Standard category were female gender, age <80 years, cardiac aetiology, non-witnessed cardiac arrest, location at home and work place, VF as first ECG rhythm, and no bystander CPR. SE, standard error; ECG, electrocardiogram; PEA, pulseless electrical activity; CPR, cardiopulmonary resuscitation; EMS, emergency medical services.

RACA Score

- Rounded coefficients
- 8 predictors
- Score X is transformed into a probability for ROSC

Table 3 **Equation of the ROSC after cardiac arrest score**

$X=$
0.3 (constant)
$+ (-0.2 \times$ male)
$+ (-0.2 \times$ age $\geq$80 years)
$+ (-0.6 \times$ trauma) $+ (0.7 \times$ hypoxia) $+ (0.5 \times$ intoxication)
$+ (0.6 \times$ witnessed by lay people) $+ (0.5 \times$ witnessed by professionals)
$+ (-0.3 \times$ nursing home) $+ (1.2 \times$ doctor's office) $+ (0.3 \times$ public place) $+ (0.5 \times$ medical institution)
$+ (-0.8 \times$ PEA) $+ (-1.1 \times$ asystole)
$+ (0.2 \times$ bystander CPR)
$+ (-0.04 \times$ minutes until EMS arrival)
Probability of ROSC $= 1/ (1 + e^{-X})$

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RACA Score

Table 4 Quality management—examples for ROSC after cardiac arrest practical use

Factor	Patients (*n*)	Observed ROSC (95% CI; %)	Predicted ROSC (%)	Impact
EMS performance				
Low level (centre A)	514	38.1 (33.9–42.3)	42.6	Negative[a]
High level (centre B)	424	47.4 (42.7–52.3)	42.6	Positive[a]
Difficulties				
Airway management	52	28.8 (18.4–39.2)	43.0	Negative[a]
Specialty				
Anaesthesiologist	2368	44.5 (42.5–46.5)	43.0	Neutral
Surgeon	316	46.5 (41.5–52.0)	45.1	Neutral
Internal medicine	2809	42.6 (40.8–44.5)	42.4	Neutral

The table demonstrates the potential role of the RACA score in quality management of the resuscitation process. By comparing the observed and predicted ROSC, we found a significant negative impact of low-level emergency medical services (EMS) performance (EMS centre A) and difficulties in airway management. High-level EMS performance from another EMS centre B resulted in a significant better observed ROSC rate, and a significant positive impact comparing observed and predicted ROSC. Comparing different specialty of emergency physicians, we found a neutral impact.

[a]Statistical significant ($P < 0.05$), if the predicted ROSC rate is not within the 95% confidence interval (95% CI) of the observed ROSC rate.

Effect on Survival

Originalarbeit

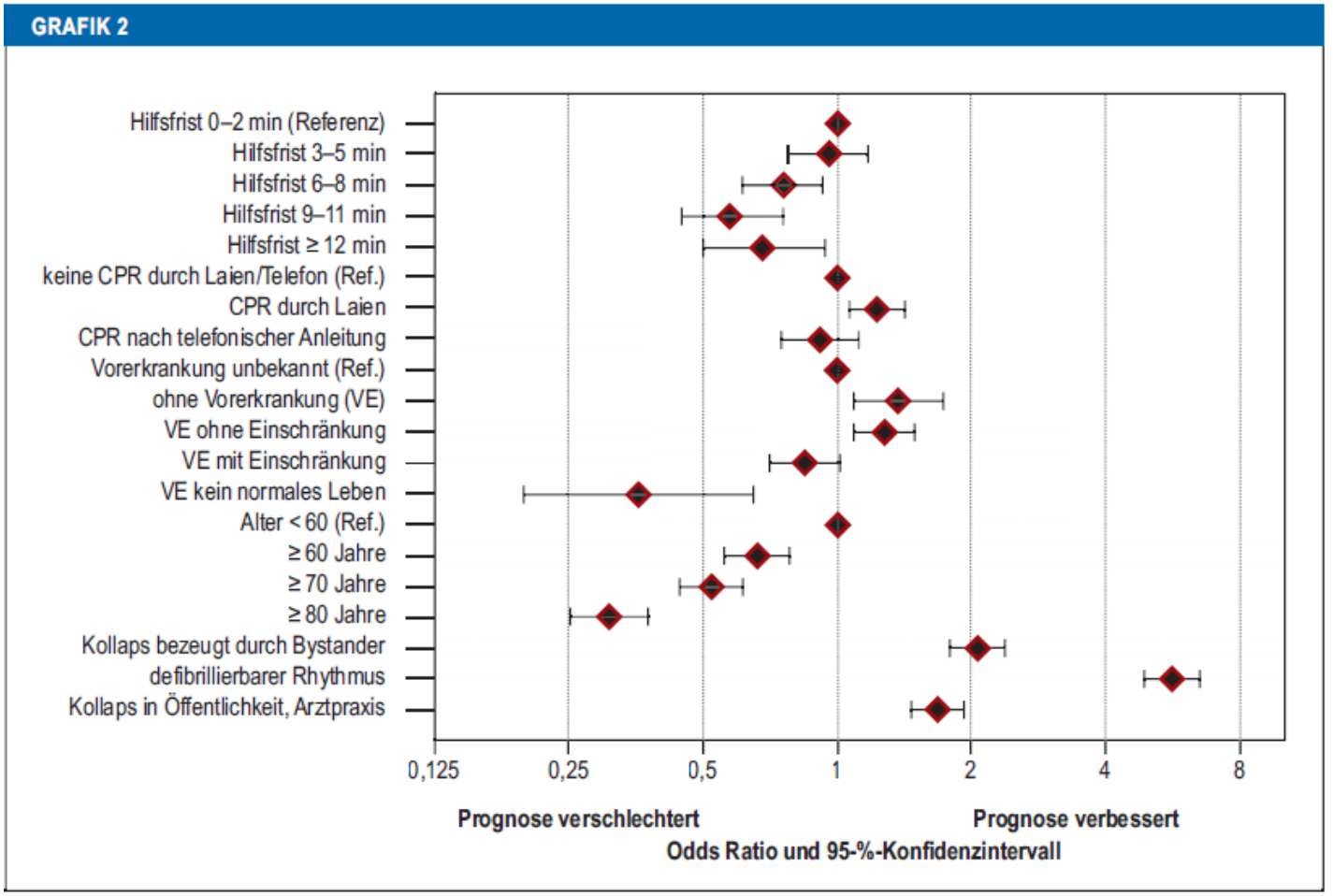
Einfluss der Hilfsfrist auf das Überleben nach plötzlichem Herz-Kreislauf-Stillstand

Analyse aus dem Deutschen Reanimationsregister

Andreas Bürger *, Jan Wnent *, Andreas Bohn, Tanja Jantzen, Sigrid Brenner, Rolf Lefering, Stephan Seewald, Jan-Thorsten Gräsner, Matthias Fischer

Effect on Survival

- time
- bystander CPR
- prior diseases
- witnessed
- age
- shockable rhythm
- location



Discussion

- Early (ROSC) and late (survival) outcome
- Several suspected and confirmed prognostic factors
- Relative importance of predictors
- Importance *versus* easy measurement
- Validation outside the own setting important
- Only good data provide good results

Discussion

General Aim: **Improve Final Outcome**

How could this be reached?

- Case selection: only CPR in promising cases
- Comparisons over time

Adjustment

- Comparisons whitin a registry / region
- Comparisons with other registries / countries
- Increase knowledge about prognostic factors