

Klassifikation für das Risikomanagement von Herzpatienten

Alexander Albert

Klinik für Kardiovaskuläre Chirurgie, Heinrich Heine-
Universität, Düsseldorf

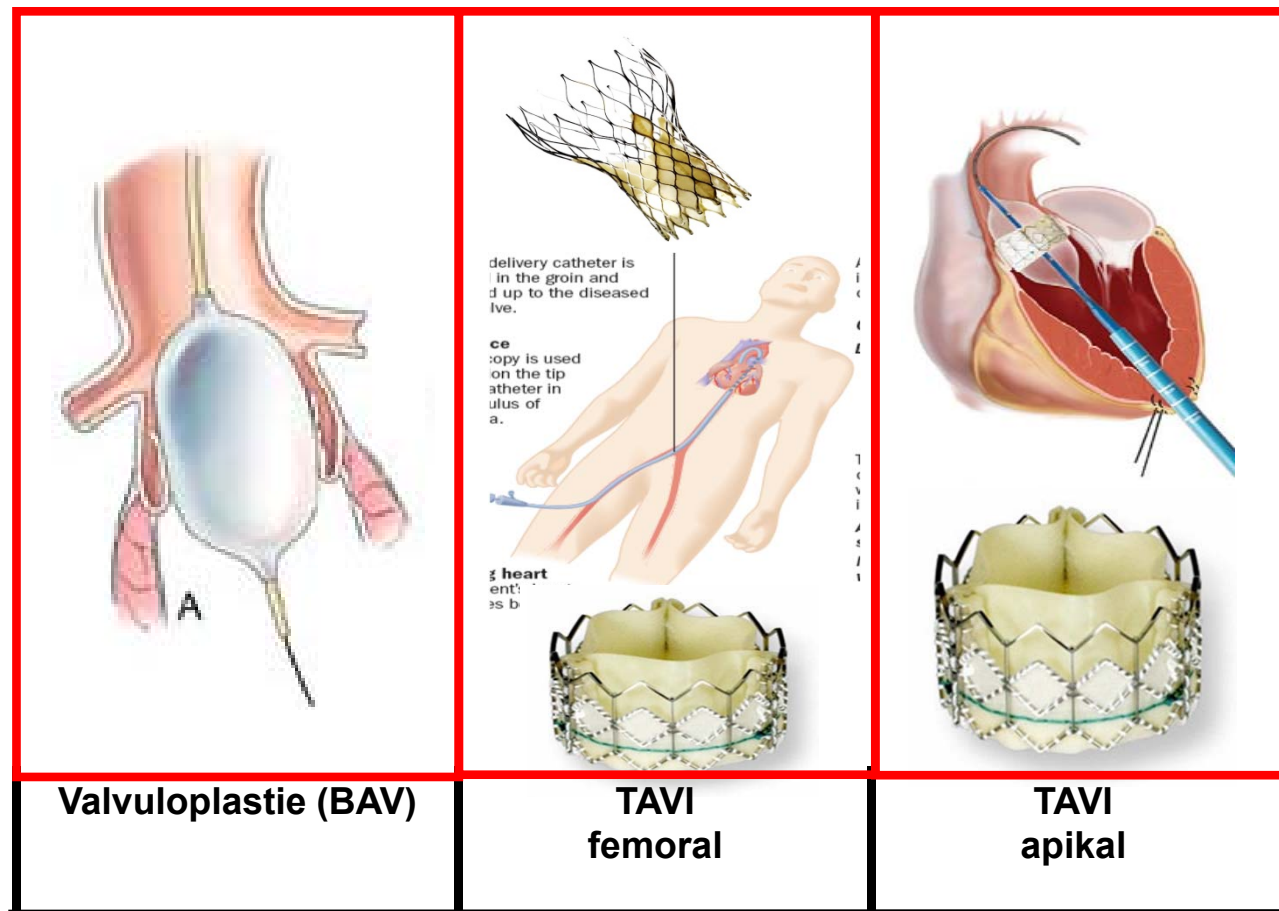


Inhalte

- Wozu werden derzeit statistische Risikoeinschätzungen in der Herzchirurgie verwendet ?
- Vorstellung von aktuellen Methoden und RisikoScores
- Limitationen
- Die Suche nach neuen Lösungen !

Klinische Bedeutung Risikoadjustierung

Beispiel: TAVI versus konventionelle OP



Transcatheter Aortic Valve Implantation (TAVI) für alle?



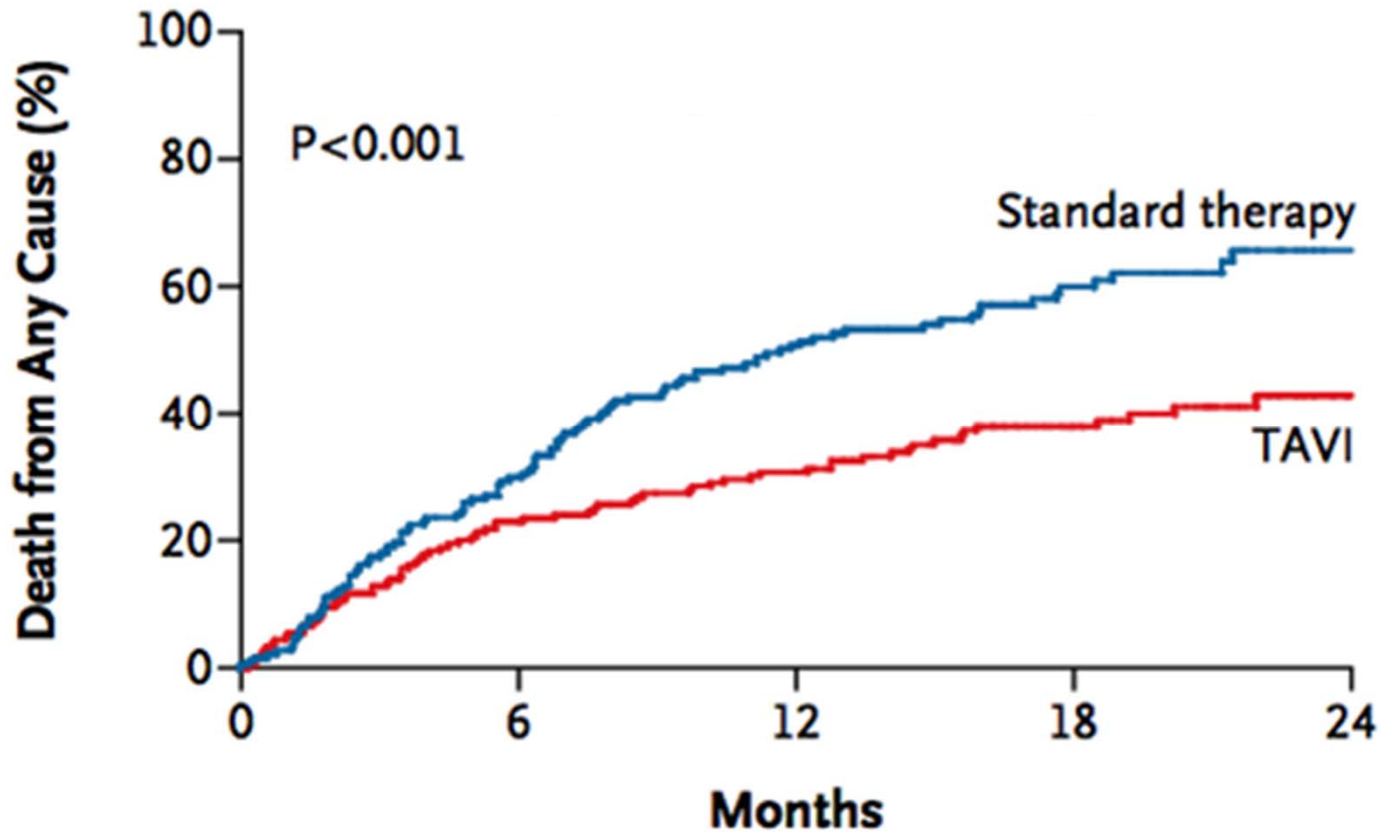
**Diese neue Herzklappe
macht Senioren glücklich**

Herzklappe express

**NEU! Herzklappe
zum Spritzen!**



Gesamtmortalität



NNT = 5 !

TAVI: Was für wen?

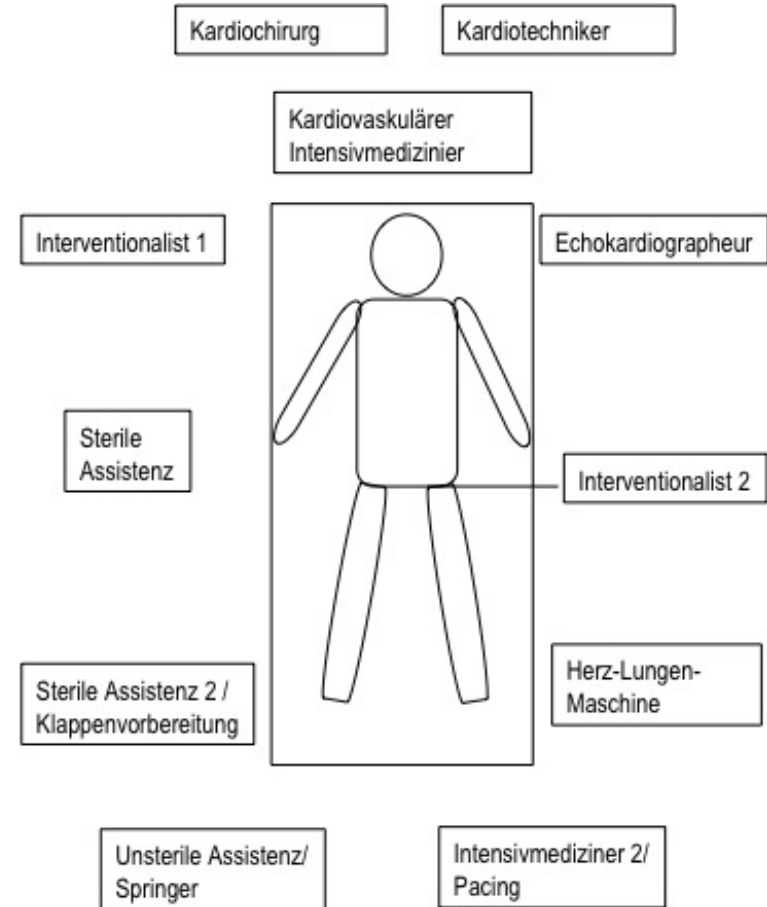
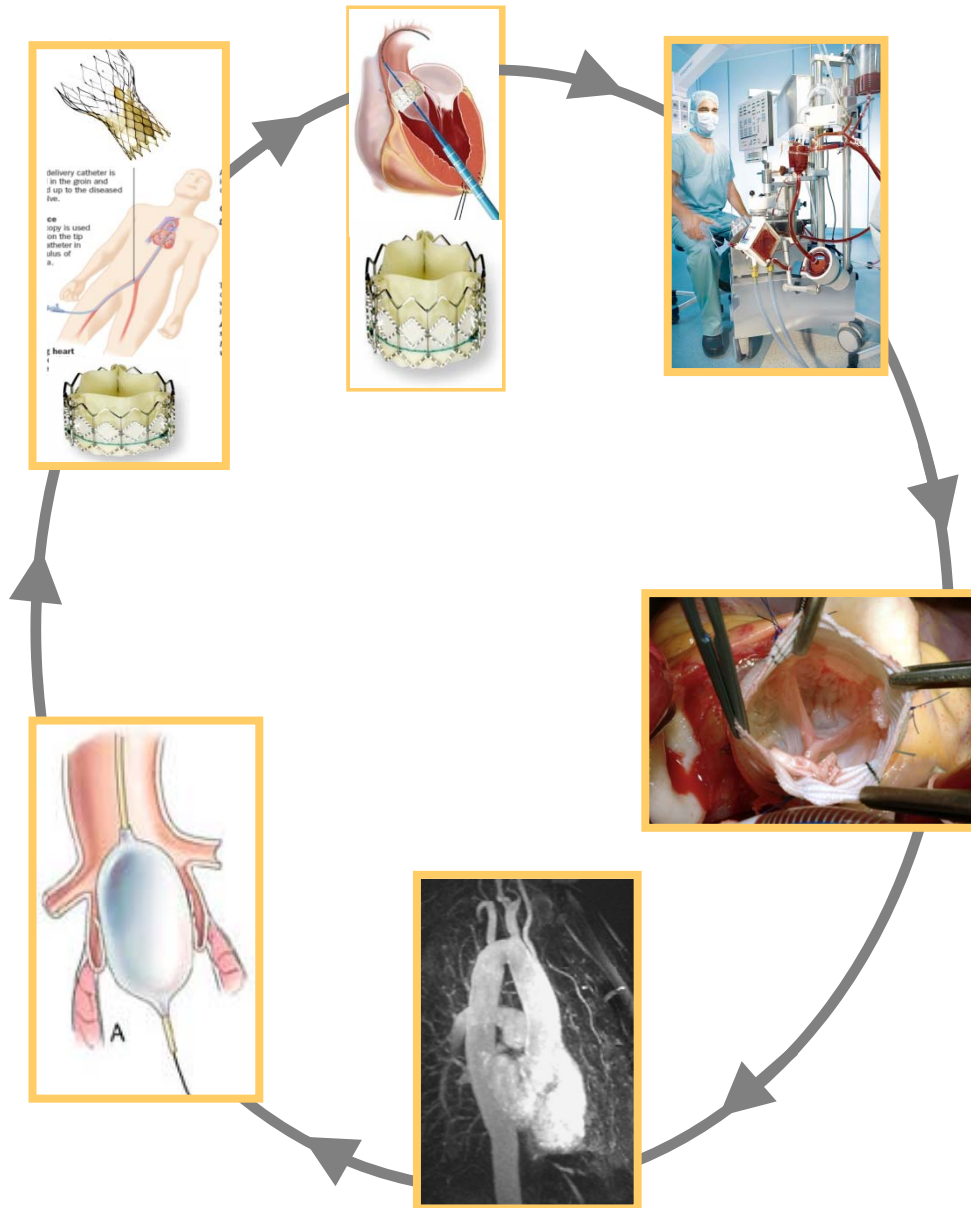
Kardiopulmonaler Status

Komorbiditäten

technische Machbarkeit

Interventioneller Aortenklappenersatz – Internes Protokoll zur TAVI-Besprechung am _____																							
Name	Helwig, Inge			Hausarzt	Dr. Wigger																		
Geb-Datum	15.05.1934			Telefon																			
Größe	161			Angehörige	Tochter																		
Gewicht	76			Telefon	0173/9848369																		
Anamnese				Diagnosen				Medikation		Labor													
CCS	II	NYHA	III	Synk	0	KHK	1 KHK (60%LAD)	ASS	0	Crea	1,5												
Historie				Euroscore		pAVK	dors Plaques AFC bds	Iscover	0	Hb	13,1												
ED	2009			Standard	15	COPD	mittelgradig	Marcumar	x	CRP	0,4												
Progress	ja			Logistic	61	Niereninsuf	GFR 35	β-Blocker	95	Leukos	6,7												
Genese	deg.			STS		cAVK	40%ACIre	ACE Hem.	2,5	Thromb	215												
LVEF (%)	UKG	TEE	HK	CT	Hämodynamik				Lungenfunktion														
>=50%	>=50%	50%	>=50%		HZV	4,2			FEV1	0,9/0,75													
AÖF (cm²)	0,8	0,9	0,6		CI	2,3			VC	1,4/1,23													
dP mean/max	27/50		ptp50		SV	35			FEV1/VC	65/61													
MI Grad/TI Grad	I	I	/III		HF	120																	
AI Grad	I-II	I	II		PVR	590																	
mPA	Pasys 100		56/110		SVR	1371																	
Anulusweite (A)	22	22		22,8	LVEDP	16																	
Sinusweite (B)				29,7	<table border="1"> <thead> <tr> <th colspan="4">EKG</th> </tr> <tr> <th>SR</th> <th>AA</th> <th>x</th> <th>AV Block</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>							EKG				SR	AA	x	AV Block				
EKG																							
SR	AA	x	AV Block																				
Sinushöhe				13																			
A. asc. Diameter (C)		30		31																			
LCA - Klappenebene (D)				8																			
RCA - Klappenebene (D)				11	<table border="1"> <thead> <tr> <th colspan="4">TAVI Planung</th> </tr> <tr> <th>RAO°</th> <th>5</th> <th>CAUD°</th> <th>7</th> </tr> </thead> <tbody> <tr> <td>Ballon</td> <td>20</td> <td>Prothese</td> <td>26</td> </tr> </tbody> </table>							TAVI Planung				RAO°	5	CAUD°	7	Ballon	20	Prothese	26
TAVI Planung																							
RAO°	5	CAUD°	7																				
Ballon	20	Prothese	26																				
AK-Verkalkung		asym recoronar		asym recoronar	<p>Besonderheiten:</p> <p>Patient vorläufig: <input type="checkbox"/> akzeptiert <input type="checkbox"/> abgelehnt wegen _____</p> <p>Empfehlung: _____</p> <p>Zugangsweg: <input type="checkbox"/> transapikal <input type="checkbox"/> re. femoral <input type="checkbox"/> li. femoral; <input type="checkbox"/> min.-inv. AKE <input type="checkbox"/> _____</p>																		
AFC li Diameter	0,8				<p>PD Dr. med. M. Merx Klinik für Kardiologie, Pneumologie und Angiologie</p>																		
AFC re Diameter	0,8				<p>Dr. med. A. Blehm Klinik für Kardiovaskuläre Chirurgie</p>																		
Kinking			mäßig																				

Sicherheit & Komplikationsmanagement



Klinische Bedeutung der Risikoadjustierung

Beispiel: Ranking Chirurgen

Professor David Taggart - Profile - Heart Surgery in Great Britain - Die Identnummer ihres Rechners lautet 5230276

http://heartsurgery.cqc.org.uk/Surgeon.aspx?ID=GMC2554271&UnitID=RP112&Unit=Department+of+Cardiothoracic+Surgery%2c+John+Radcliffe+Hospital&OT=1

Professor David Taggart - Profile - Heart Surgery in G...

Homepage Survival rates Information for patients About this site

Homepage / Survival rates / About all cardiac surgery / Cardiac unit / Surgeon

Professor David Taggart

Department of Cardiothoracic Surgery, John Radcliffe Hospital

About Professor David Taggart

Specialities
Adult Cardiac Surgery
Thoracic Surgery

Qualified
Glasgow University 1981

Trained
Royal Infirmary, Glasgow 1985-1989
La Pitié Opital, Paris 1990
Freeman Hospital, Newcastle 1991
Royal Brompton Hospital, London 1992-95


Previous consulting posts
Data not provided

Address:
Department of Cardiothoracic Surgery,
John Radcliffe Hospital,
Headley Way,
Oxford,
OX3 9DU

Tel: 01865 221121

Email:
[Email Address](#)

Image
not available



Practice profile for the 3 years ending March 2009

Total number of operations performed: 600

Practice Profile (the proportion of operations performed by each surgeon)

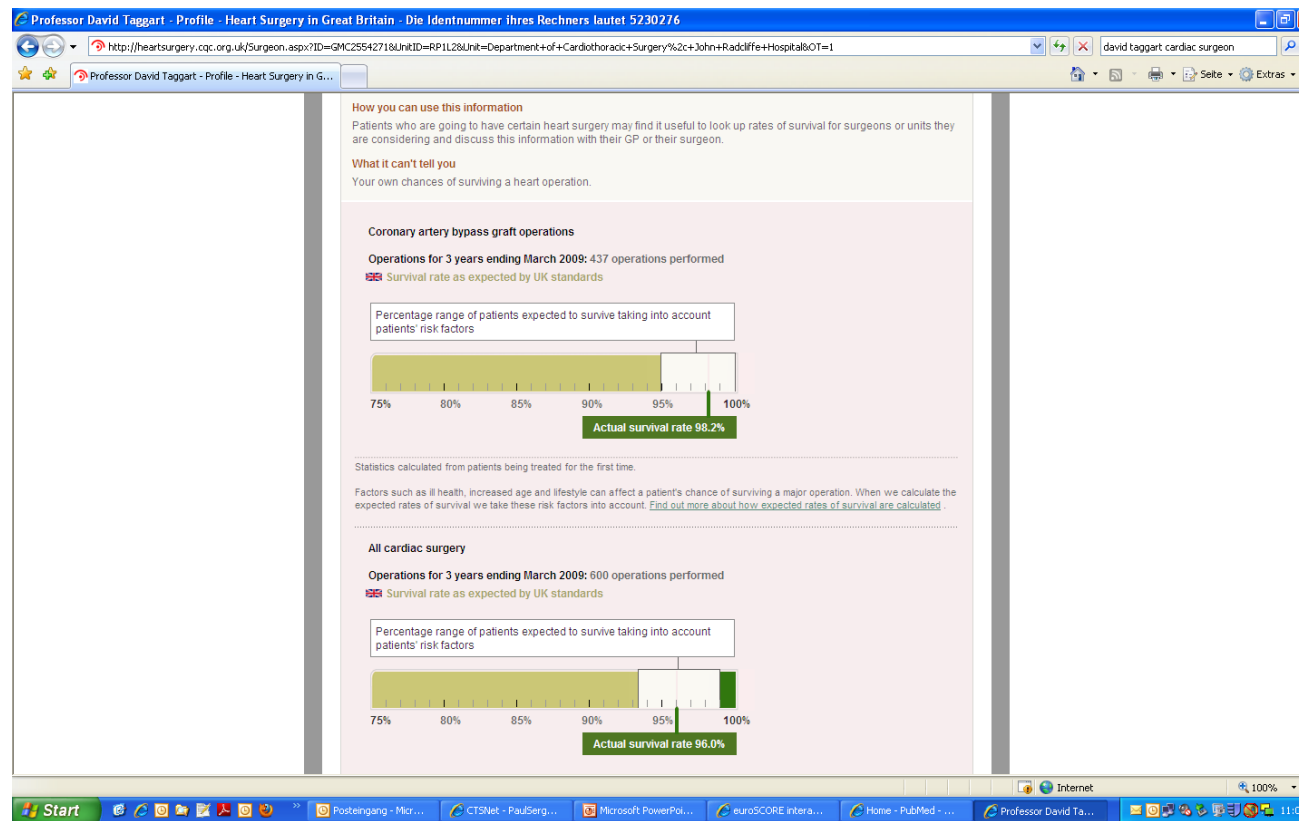
Heart Bypass		Valve Repair or Replacement		Other
Alone	with aortic valve replaced	aortic valve	mitral valve	

Rates of survival after selected types of heart operation

Start | Posteingang... | CTSNet - Paul... | Microsoft Pow... | euroSCORE in... | Home - PubMe... | Professor Davi... | PowerPoint-Bil... | 11:02

Klinische Bedeutung der Risikoadjustierung

Beispiel: Ranking Chirurgen



Klinische Bedeutung der Risikoadjustierung

Beispiel: Ranking Chirurgen

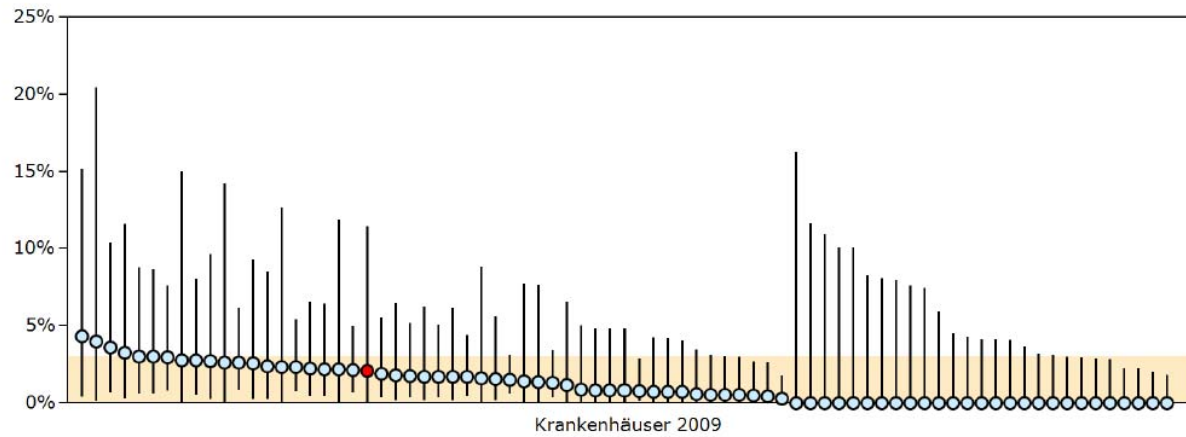
Surgeon Observed, Expected, and Risk-Adjusted Mortality Rates (RAMR) for Coronary Artery Bypass Grafts in New York State, 1996-1998 Discharges

	Cases	No. of Deaths	OMR	EMR	RAMR	95% CI for RAMR
Albany Medical Center Hospital						
##Banker M	7	1	14.29	2.07	15.69	(0.21, 87.29)
Britton L	413	4	0.97	1.52	1.45	(0.39, 3.72)
Canavan T	519	2	0.39	1.50	0.58 **	(0.07, 2.11)
Foster E	239	3	1.26	1.86	1.53	(0.31, 4.48)
#Joyce F	122	2	1.64	1.24	2.99	(0.34, 10.81)
Kelley J	593	18	3.04	1.71	4.04 *	(2.39, 6.38)
Luber J	329	8	2.43	1.91	2.89	(1.24, 5.69)
Miller S	460	3	0.65	2.03	0.73 **	(0.15, 2.14)
#Sardella G	158	0	0.00	1.25	0.00	(0.00, 4.21)
All Others	105	2	1.90	1.72	2.52	(0.28, 9.08)
TOTAL	2945	43	1.46	1.69	1.97	(1.42, 2.65)
Arnot Ogden Memorial Hospital						
Quintos E	266	13	4.89	1.98	5.61 *	(2.98, 9.59)
Vaughan J	89	2	2.25	2.05	2.49	(0.28, 9.01)
All Others	14	0	0.00	1.36	0.00	(0.00, 43.66)
TOTAL	369	15	4.07	1.97	4.68 *	(2.62, 7.72)

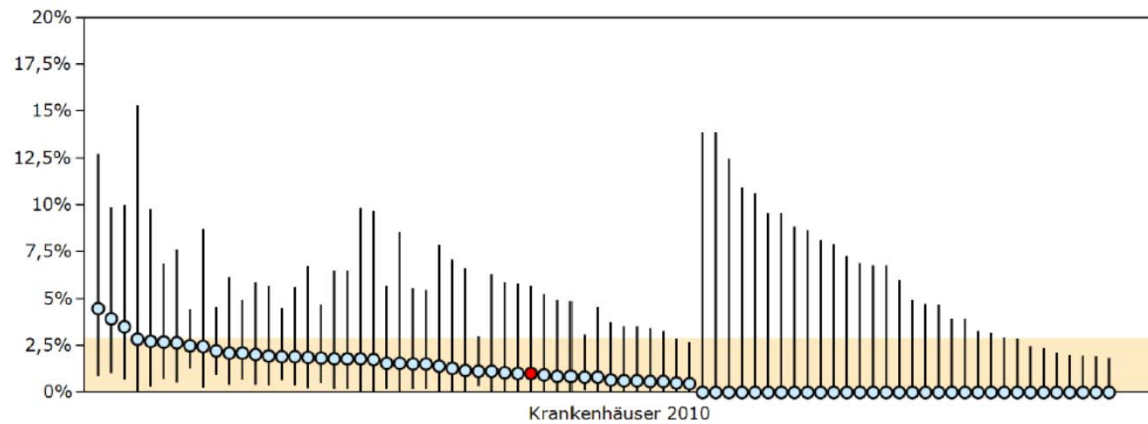
Klinische Bedeutung der Risikoadjustierung

Beispiel: Ranking Kliniken (AQUA)

X



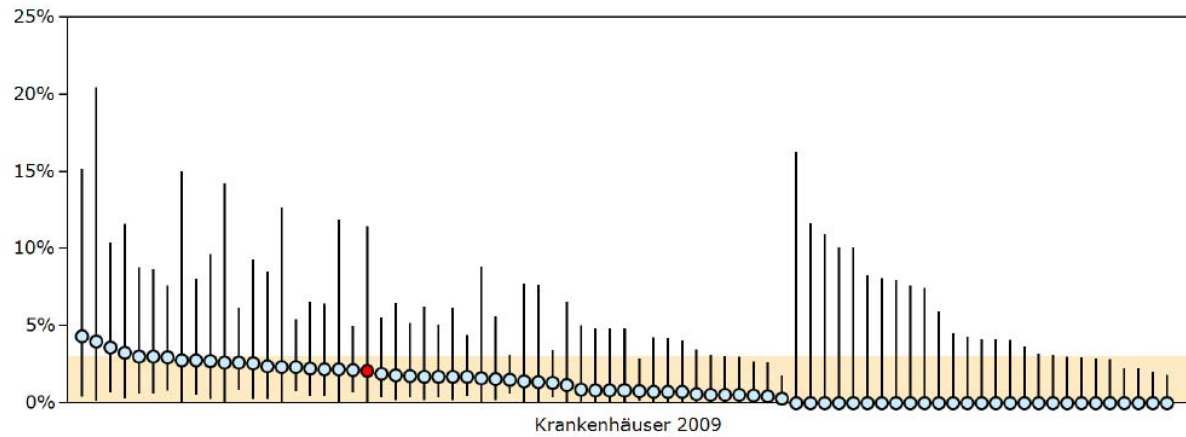
X



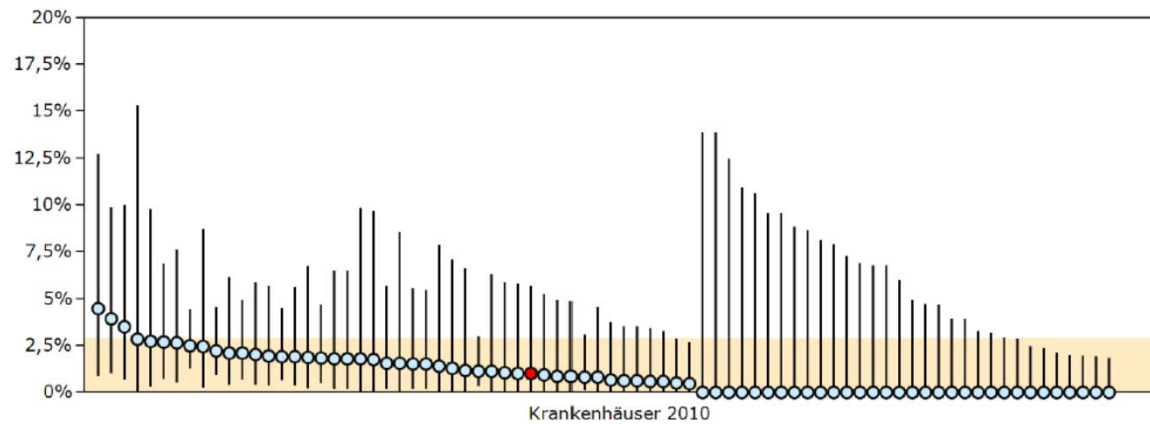
Klinische Bedeutung der Risikoadjustierung

Beispiel: Ranking Kliniken (AQUA)

X

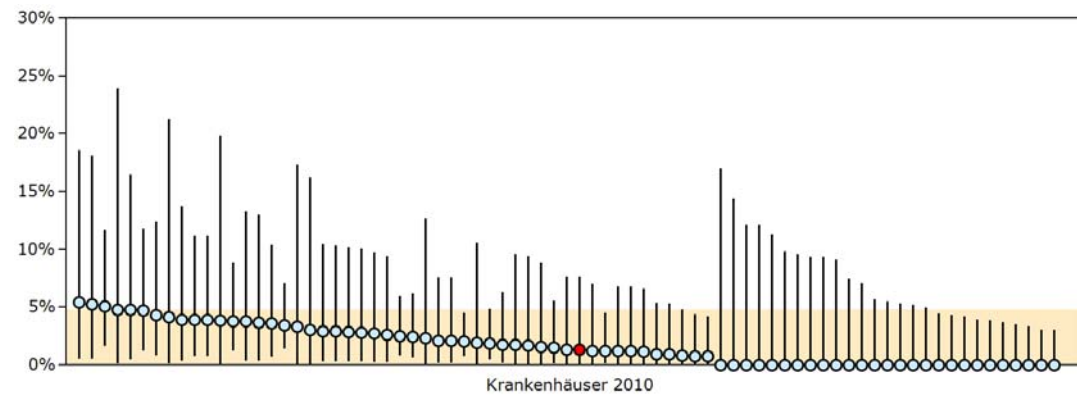
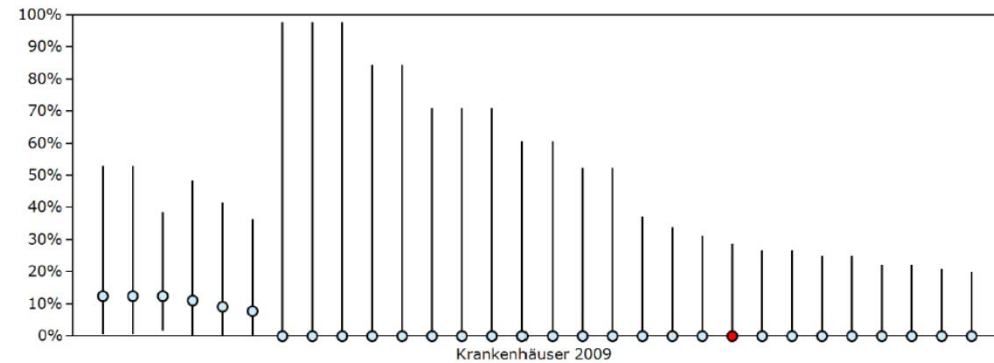
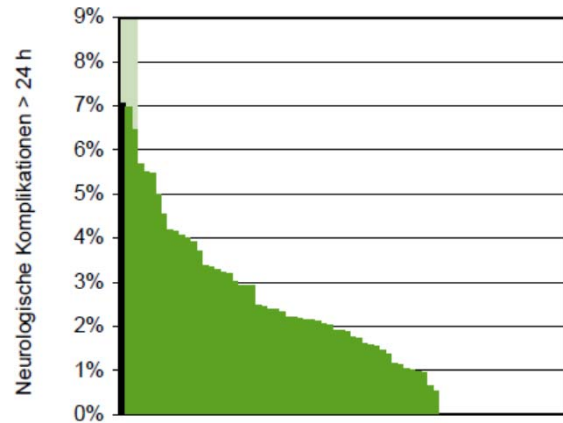


X



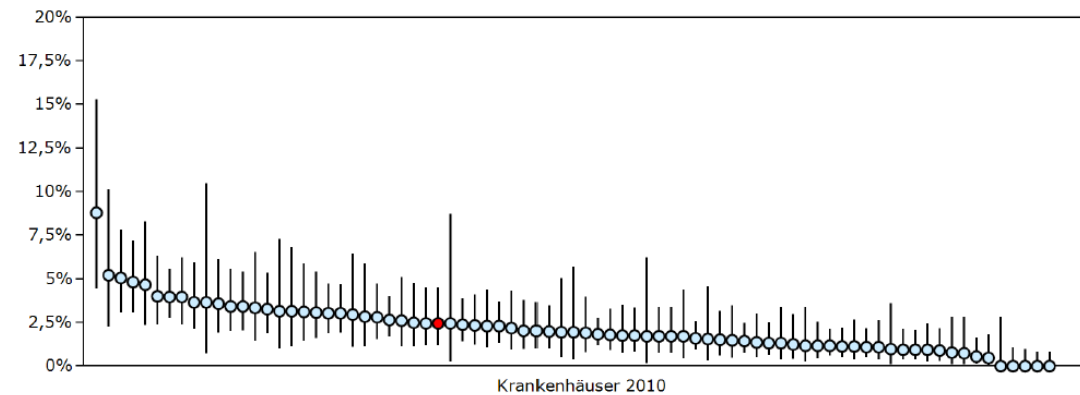
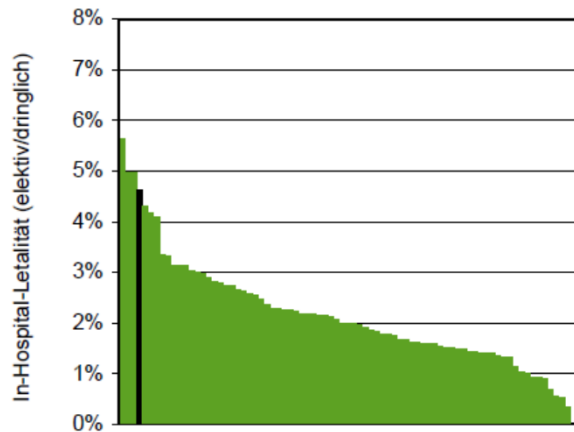
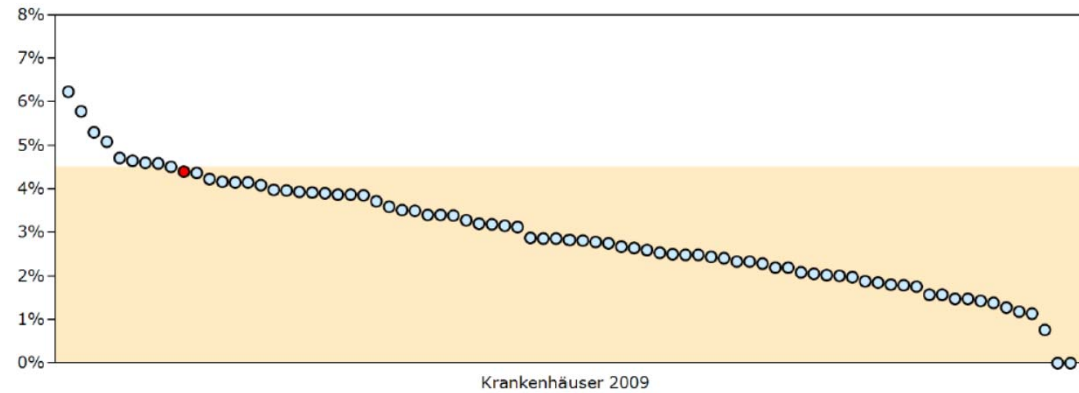
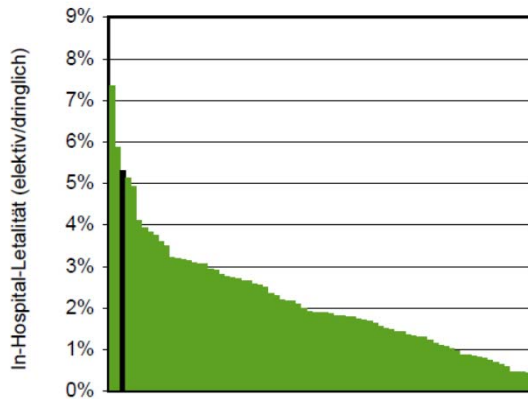
Klinische Bedeutung der Risikoadjustierung

Beispiel: neurologische Komplikationen, Ranking Kliniken (AQUA)



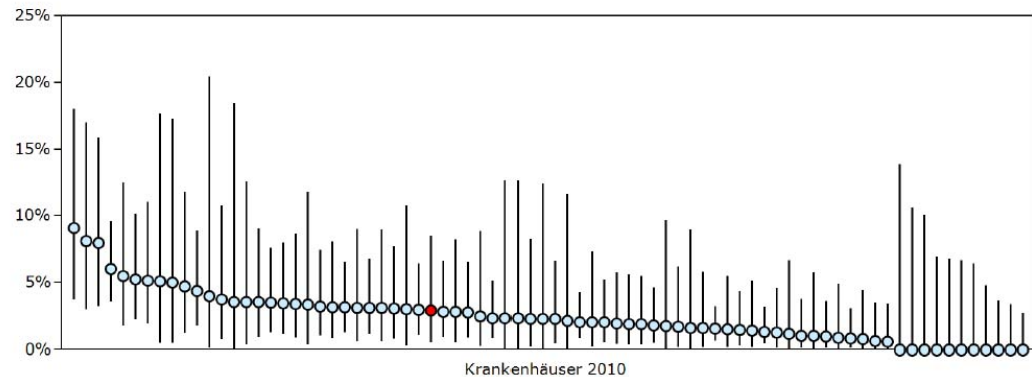
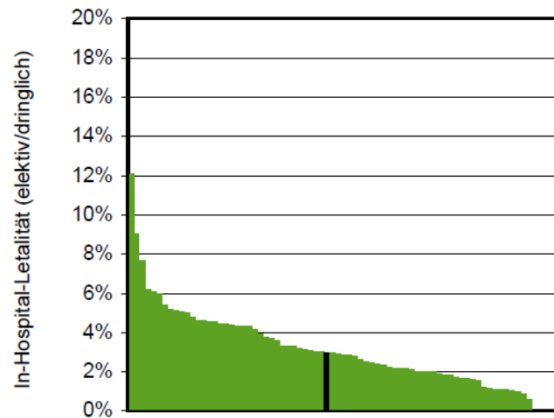
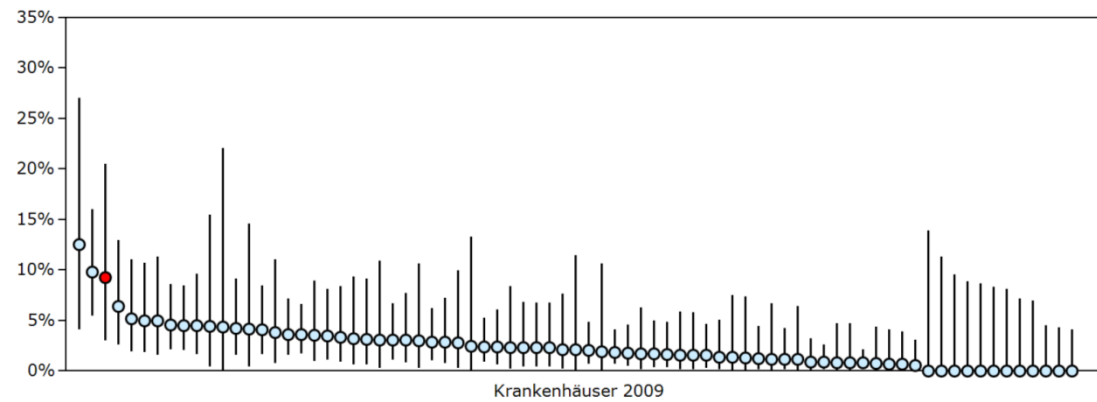
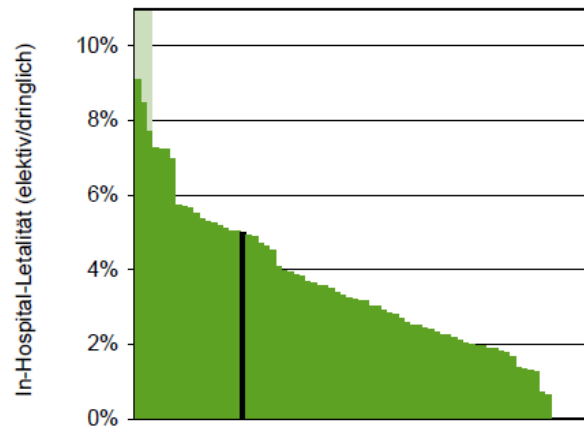
Klinische Bedeutung der Risikoadjustierung

Beispiel: Letalität ACB, Ranking Kliniken (AQUA)

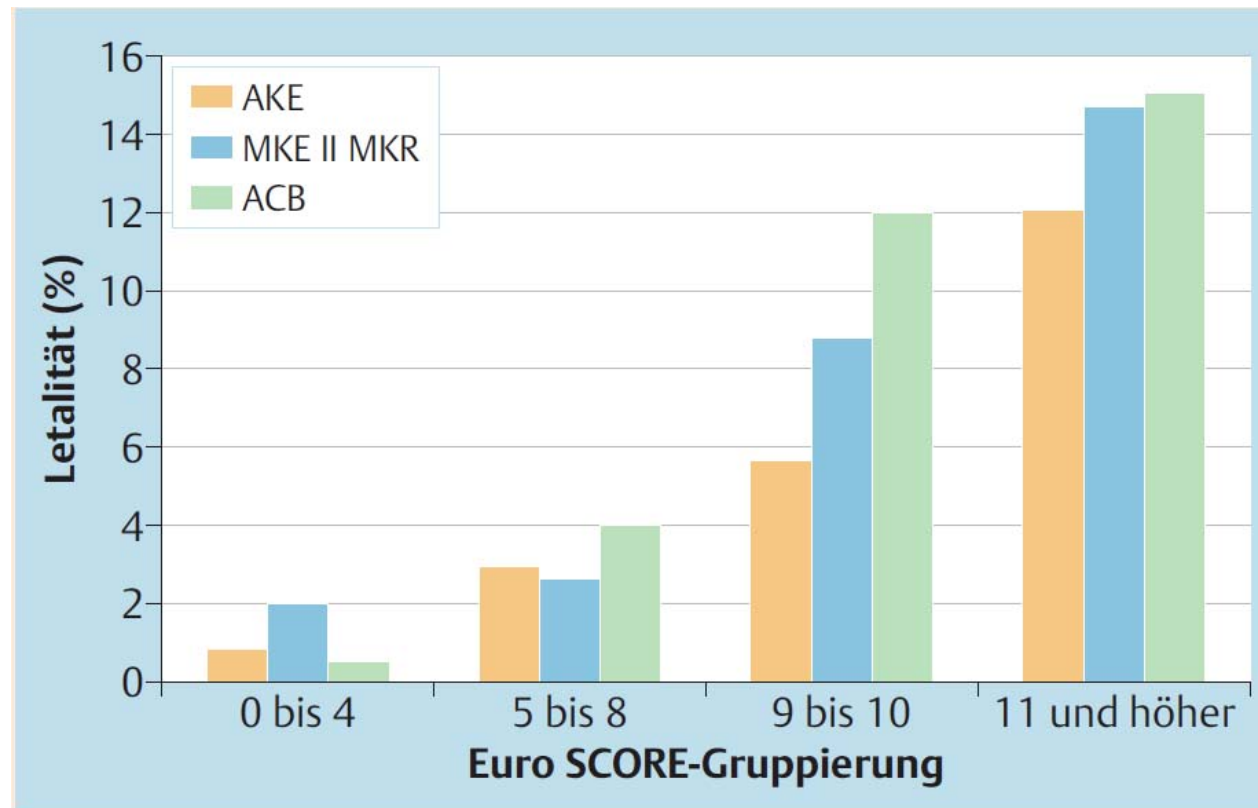


Klinische Bedeutung der Risikoadjustierung

Beispiel: Letalität AKE, Ranking Kliniken (AQUA)

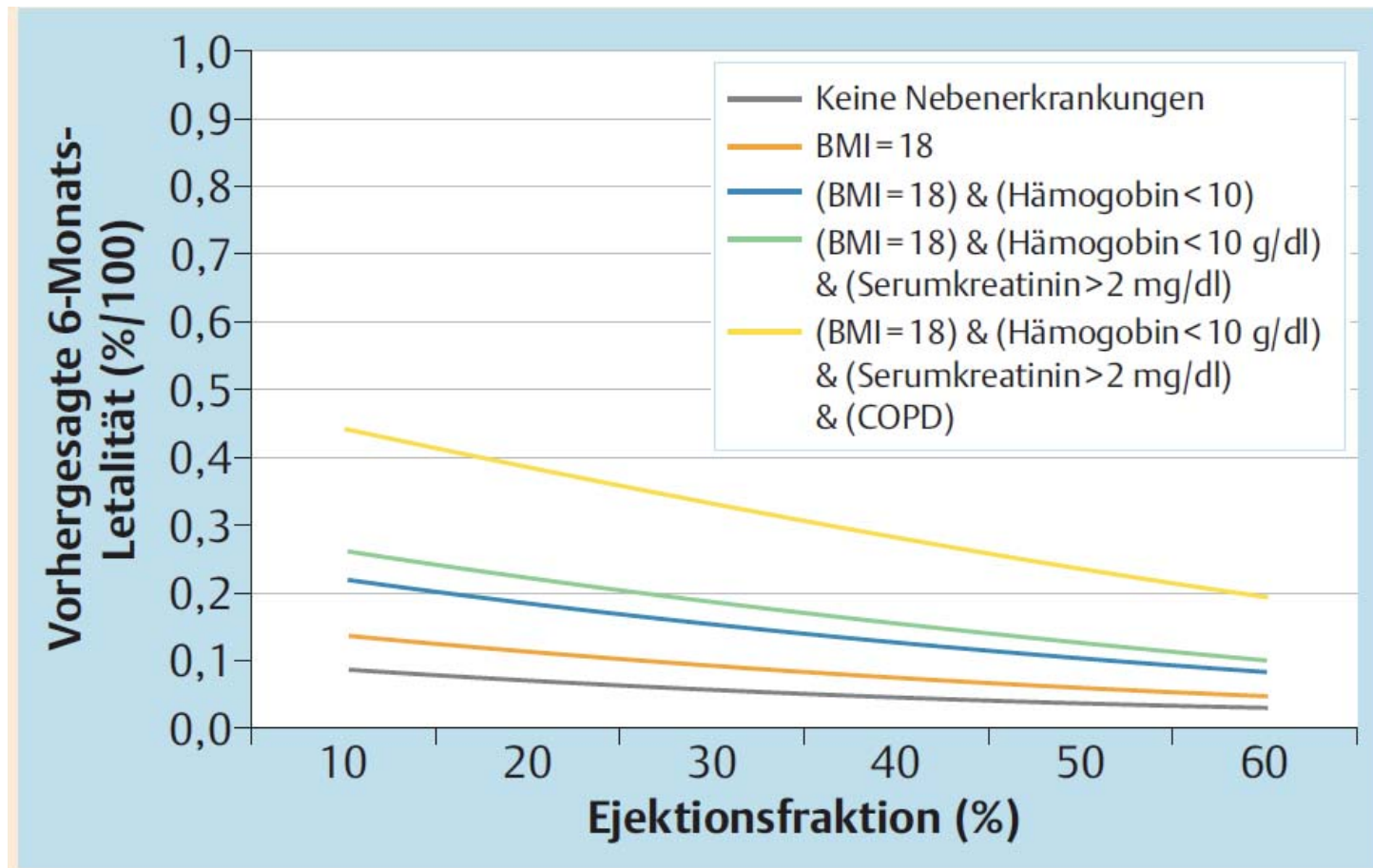


6-Monats-Letalität nach EuroSCORE bei Pat. > 80 Jahre



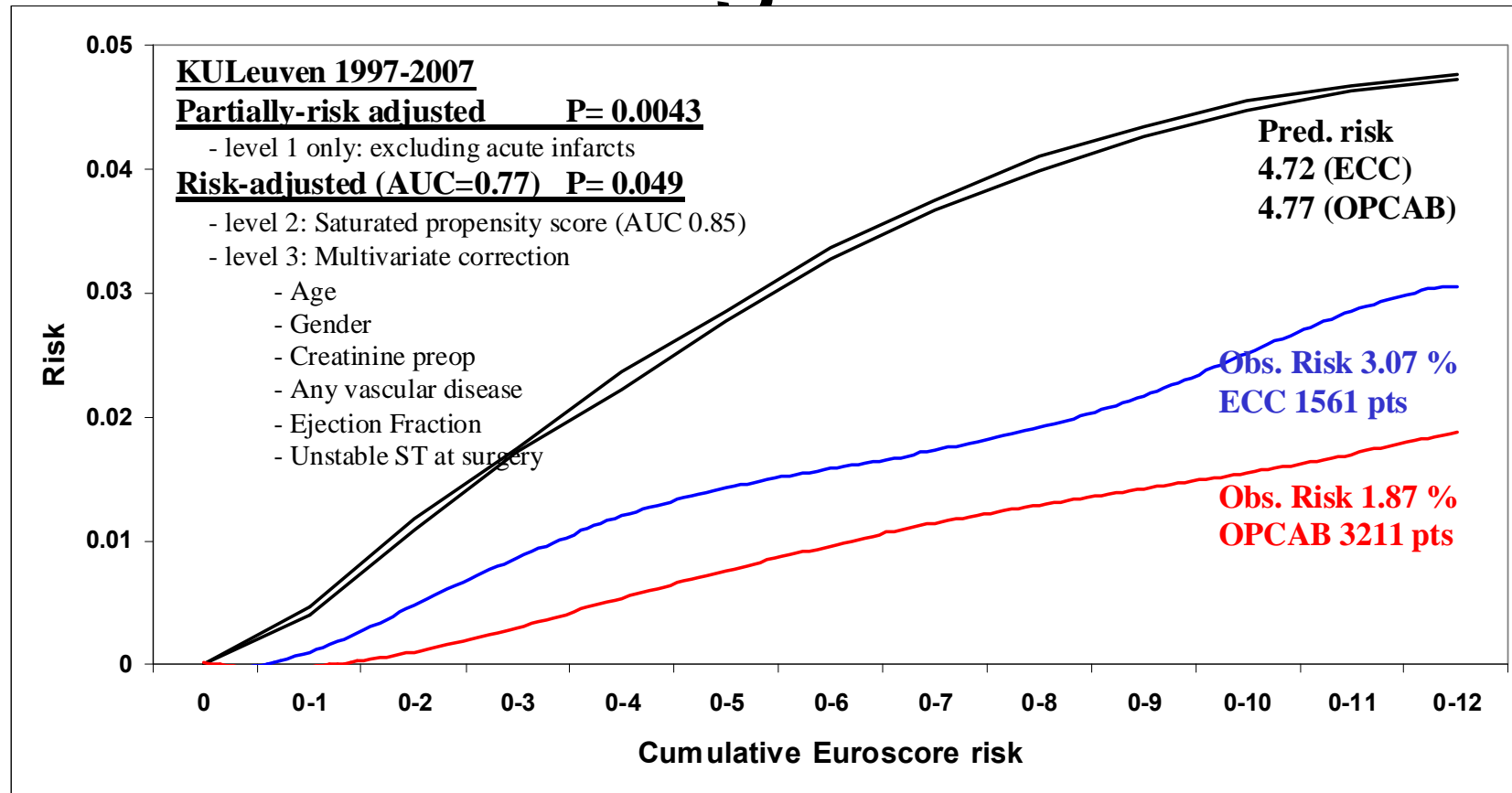
Albert et al. Dtsch Med Wochenschr 2008. 133:2393-2402

Exemplarische Berechnung der 6-Monats-Letalität nach Risikofaktoren bei Pat. >80 Jahre



Albert et al. Dtsch Med Wochenschr 2008. 133:2393-2402

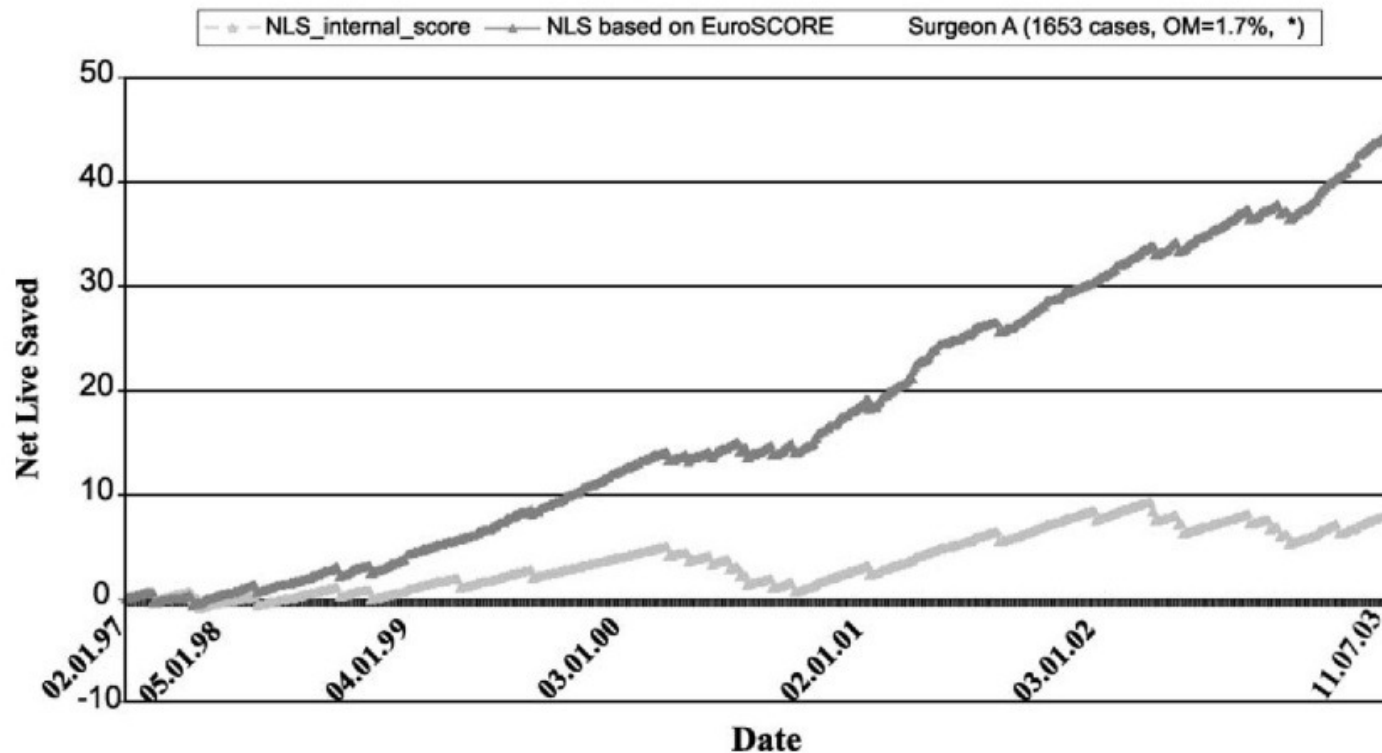
Operationsrisikos durch Vermeidung der Herz-



nach Sergeant P. et al. ...*Eur J Cardiothorac Surg* 2004; 25:779-785

Interne Qualitätssicherung

VLAD based on EuroSCORE and internal score



■ **CHRONIKALISCH**

A.A. Albert et al. / *European Journal of Cardio-thoracic Surgery* 25 (2004) 312–319

Patient data	IPS	CCS	FS	ES	PS	OPRS
Age	✓	✓	✓	✓	✓	✓
Gender	✓			✓		✓
Body weight	✓	✓				
Cardiac data						
Unstable angina				✓		
Aortic stenosis	✓	✓				
Aortic valve surgery	✓					
Mitral valve surgery	✓				✓	
Single valve						✓
Active endocarditis				✓		
Congenital heart defect	✓					
Hypertension, arterial	✓					
Hypertension, pulmonary	✓			✓		
LV aneurysm	✓				✓	
LV ejection fraction	✓	✓	✓	✓		✓
Mitral insufficiency		✓				
Only venous bypass			✓			
MI < 48h			✓			
MI < 3 month				✓	✓	
NYHA					✓	
Post MI VSD			✓	✓		
Ventricular tachycardia/fibrillation			✓	✓		

Pulmonary data	IPS	CCS	FS	ES	PS	OPRS
COPD*/Asthma	√	√		√		
Renal data						
Dialysis	√		√			
Creatinine		√	√	√	√	
Actual renal failure	√			√		
Vascular data						
Aortic dissection/surgery			√	√	√	
Peripheral arterial disease				√		
History of vascular/cardiac surgery		√				
Preoperative data						
Ventilation			√	√	√	
IABP	√			√		
Inotropes				√		
Resuscitation				√		
Cardiogenic shock	√				√	
Operation data						
Combined surgery	√		√	√	√	√
TKR			√		√	
Pulmonal <i>Embolektomie</i>			√			
Transplantation			√			
Urgent/emergency	√	√		√	√	√
Reoperation	√	√	√	√	√	√
Other data						
Anemia		√				
Diabetes	√	√				
Liver disease					√	
History of TIA, stroke		√		√		
Paraplegia	√					
Pacemaker	√					

By selecting "Standard euroSCORE" euroSCORE values are simply added to estimate risk of death as described in

[Roques F, Nashef SA, et al. Eur J Cardiothorac Surg. 1999 Jun;15\(6\):816-22](#)

By selecting "Logistic euroSCORE" - euroSCORE predicted mortality is calculated as follows (manuscript in preparation):

$$\text{Predicted mortality} = \frac{e^{(\beta_0 + \sum \beta_i X_i)}}{1 + e^{(\beta_0 + \sum \beta_i X_i)}}$$

e is the natural logarithm = 2.718281828...

β_0 is the constant of the logistic regression equation = -4.789594

β_i is the coefficient of the variable X_i in the logistic regression equation provided in the table below.

$X_i = 1$ if a categorical risk factor is present and **0** if it is absent

For age, **$X_i = 1$** if patient age < 60; **X_i** increase by one point per year

hence for age 59 or less **$X_i = 1$** , age 60 **$X_i = 2$** , age 61 **$X_i = 3$** , *and so on.*

euroSCORE interactive calculator (standard/logistic regression)in GERMAN V1.8 - Die Identnummer ihres Rechners lautet 5230276

http://euroscore.org/calcge.html

HOME *euroSCORE* SCORING CALCULATOR REFERENCES

euroSCORE interactive calculator

euroSCORE (deutsch)

Patient		Kardial	
Alter	<input type="text" value="0"/>	<input type="text" value="0"/>	Instabile Angina pectoris⁵
Geschlecht	...	<input type="text" value="0"/>	<input type="text" value="Nein"/>
COPD¹	Nein	<input type="text" value="0"/>	<input type="text" value="0"/>
Extrakardiale Arterienerkrankung²	Nein	<input type="text" value="0"/>	Eingeschränkte EF
Neurologische Erkrankungen³	Nein	<input type="text" value="0"/>	...
vorangegangene Perikarderöffnung	Nein	<input type="text" value="0"/>	Frischer Myocardinfarkt⁷
präop Kreatinin > 200 µmol/ L	Nein	<input type="text" value="0"/>	Nein
Akute Endokarditis⁴	Nein	<input type="text" value="0"/>	Pulmonale Hypertonie⁸
Präoperativ Intensivpatient⁴	Nein	<input type="text" value="0"/>	Nein
		Operation	
		Notfallindikation⁹	Nein
		Kombinationseingriff: kein isolierter ACVB-Eingriff	Nein
		Thorakaler Aorteneingriff	Nein
		Postinfarkt-VSD	Nein

Logistic **EuroSCORE**

Calculate Clear

By selecting "**Standard euroSCORE**" euroSCORE values are simply added to estimate risk of death as described in [Roques F, Nashef SA, et al. Eur J Cardiothorac Surg. 1999 Jun 15\(6\):816-22](#)

By selecting "**Logistic euroSCORE**" - euroSCORE predicted mortality is calculated as follows (manuscript in preparation):

Predicted mortality = $e^{(\beta_0 + \sum \beta_i X_i)} / 1 + e^{(\beta_0 + \sum \beta_i X_i)}$

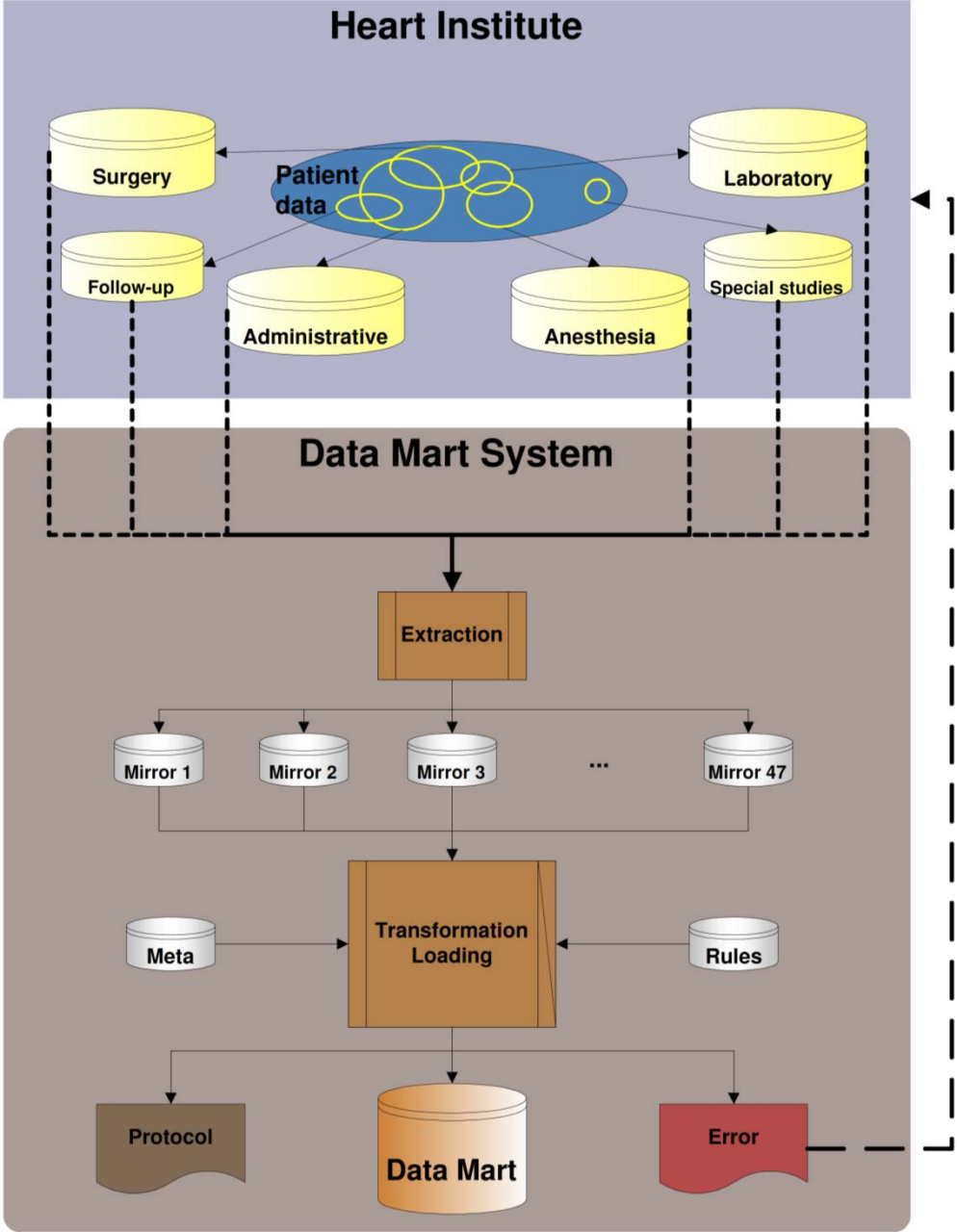
[Click here for full details on how to calculate Logistic euroSCORE](#) [Calculator version 1.8 Updated 17th May 2002]

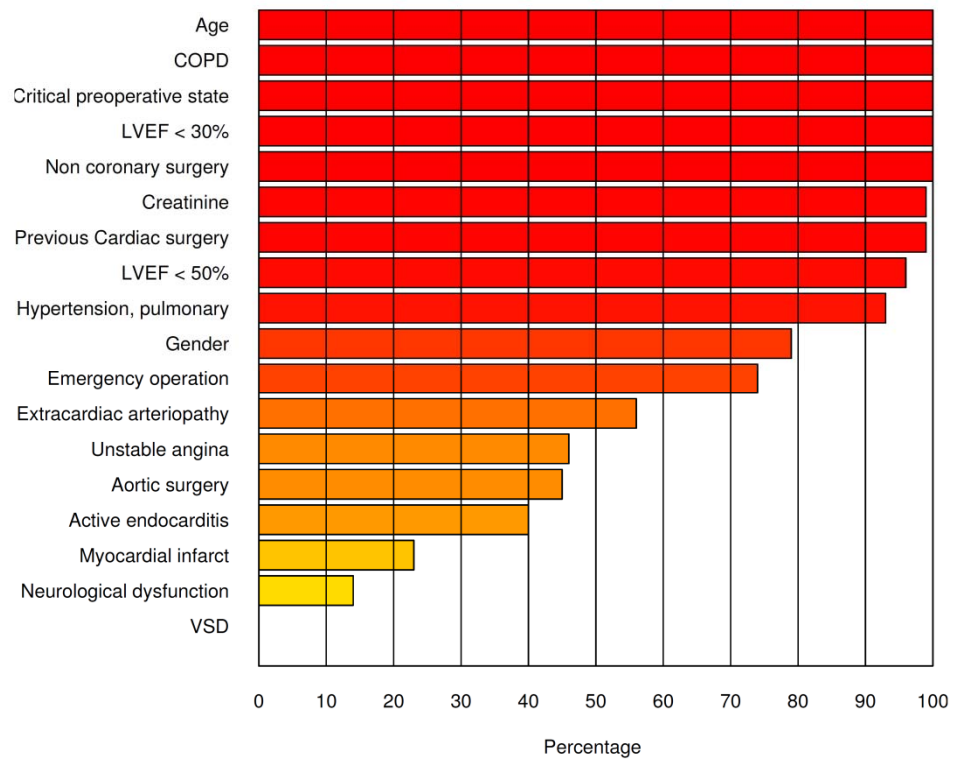
Kommentar

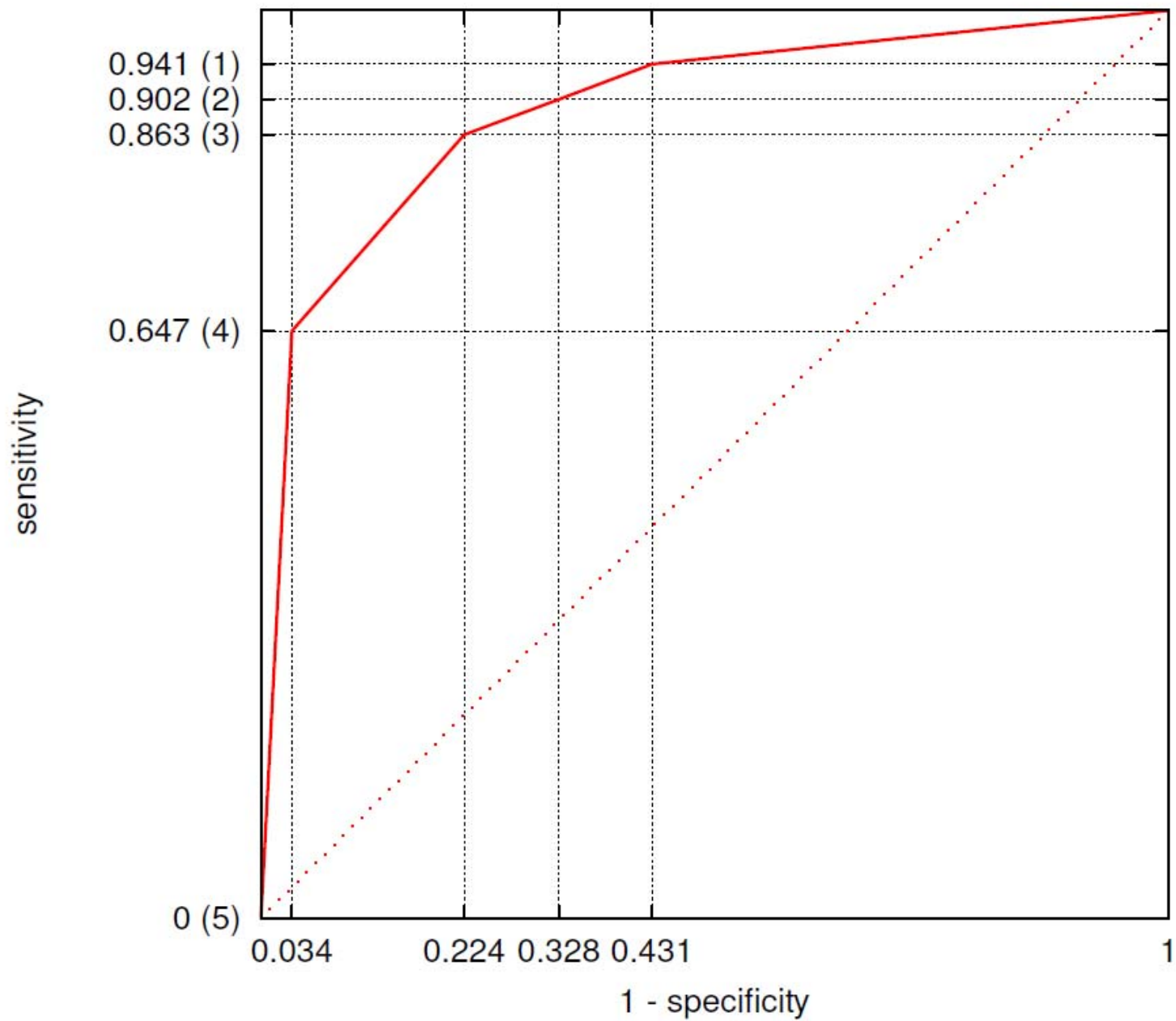
Start Posteingang - Micros... CTSNet - PaulSergea... C:\Dokumente und El... Microsoft PowerPoint ... euroSCORE interactiv... 10:31

Statistischen Methoden in herzchirurgischer Praxis

- Datamart
- Bootstrapping
- ROC
- Objektive Messwerte versus subjektiver Einschätzung der Ärzte
- Online Monitoring der ärztlichen Performanz
- VLADs (Cusum curves)
- Klassifikationsbäume
- Bedeutung der Variablen-transformation für das logistische Modell
- Finden Cut-points
- Observed versus predicted
- Cox-regression, Überlebensanalysen
- Neuronale Netze







Attribute	Coefficient β
Age [years]	0.218
Gender	0.469
Bilirubin [mg/dl]	0.342
Urea [mg/dl]	0.268
Lactat dehydrogenase [U/l]	0.360
Glucose [mg/dl]	0.170
Antithrombin III (%)	-0.198
Partial thromboplastin time [sec]	0.243
Lymphocyte count (%)	-0.248
Haemoglobin concentration (%)	-0.220
Ejection fraction (%)	-0.291

	ES	IPS	CCS	PS	OPS	FS
Objective Score	↑	↑	↑	↑	↑	↑

DataMart Online-Reports - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

DataMart Online-Reports

Surgical procedures

- CABG
- OPCAB
- AVR
- AVR + CABG
- MVR
- MVR + CABG
- AVR + MVR

Surgeons

- A
- B
- C
- D
- E
- F
- G

Expected Lethality

- EuroSCORE (ES)
- Cleveland Clinic Score (CCS)
- Initial Parsonnet Score (IPS)
- French Score (FS)
- Pons Score (PS)
- Ontario Province Risk Score (OPRS)
- BQS Score (BQSS)

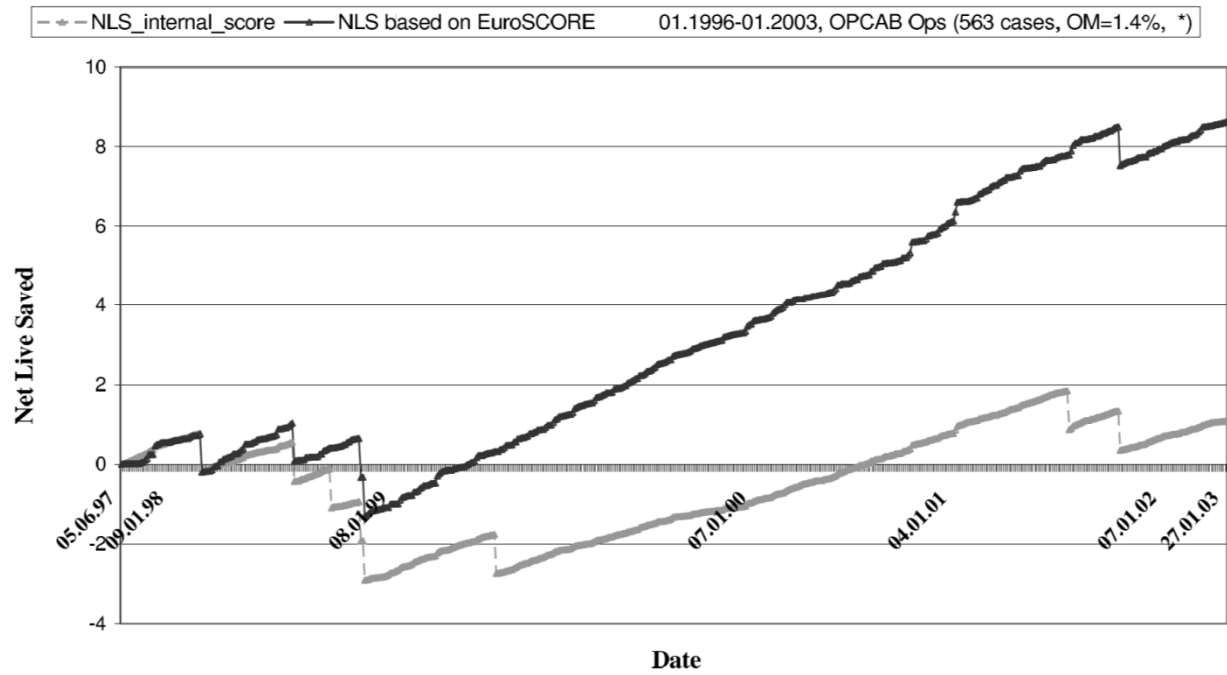
Time period 01.01.2004 - 31.12.2004

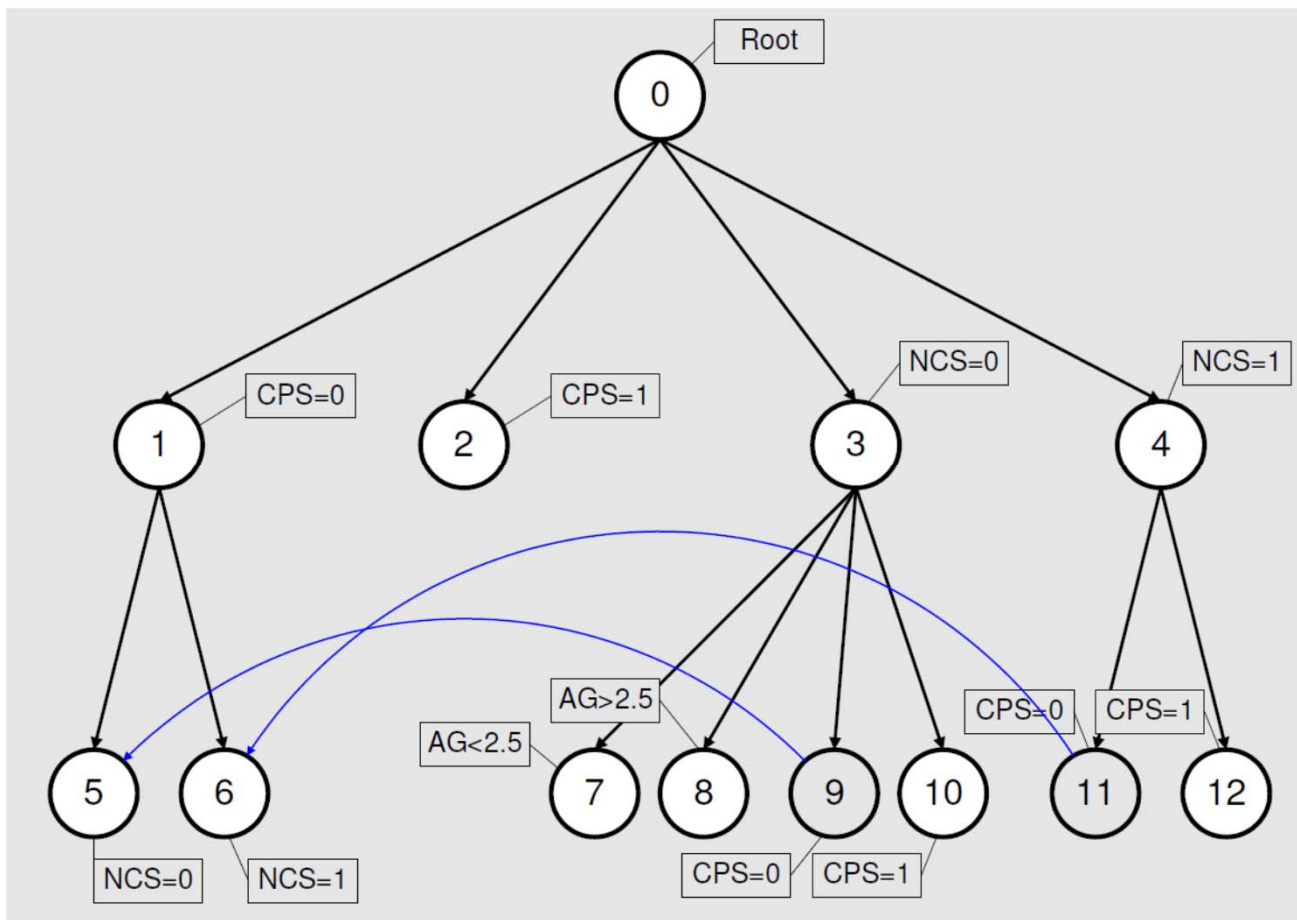
Procedure	Surgeon	N	N deceased	ELet ES	ELet IPS
CABG	All	760	9 (1.18%)	15.3 (2.01%)	12.0 (1.58%)
AVR	All	196	3 (1.53%)	10.7 (5.48%)	6.9 (3.51%)
AVR + CABG	All	121	3 (2.48%)	7.4 (6.08%)	5.7 (4.73%)

Time period 01.01.1996 - 31.08.2005

Procedure	Surgeon	N	N deceased	ELet ES	ELet IPS
All	A	2187	38 (1.74%)	83.4 (3.81%)	60.9 (2.79%)
All	B	986	8 (0.81%)	19.0 (1.93%)	15.1 (1.53%)

VLAD based on EuroSCORE and internal score





Akaike information criterion for several transformations of risk factors. Transformation with the lowest AIC and included into the final model was highlighted in bold letters.

Transformations of risk factors	AIC
1. Age linear	401
2. Age >84 years	398
1. Ejection fraction linear	398
2. Ejection fraction <60%	394
1. BMI linear	394
2. (BMI-26) ²	398
3. (BMI-26) ³	393
4. BMI <24	391
5. BMI <23 or BMI >28	393
1. Creatinine linear	391
2. Creatinine >1.2 mg/dl	393
1. Blood glucose linear	392
2. Blood glucose >130 mg/dl	393

BMI: body mass index; CI: confidence interval.

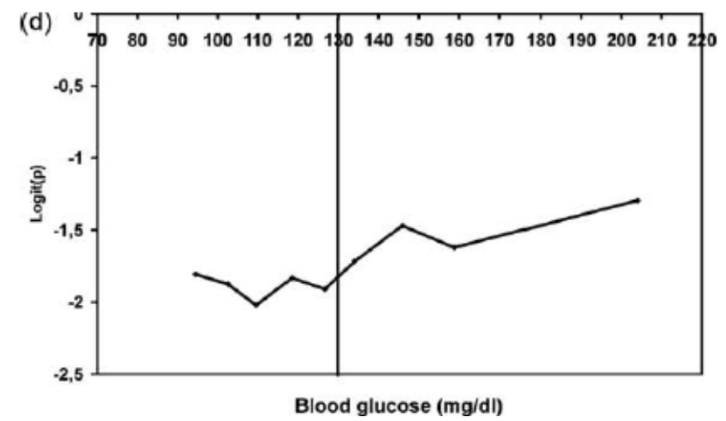
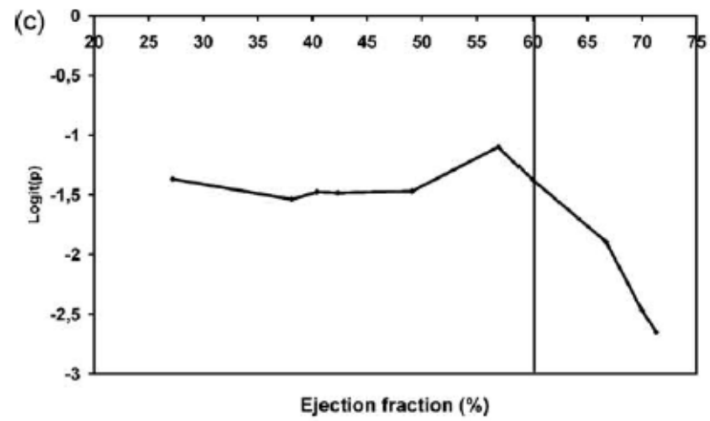
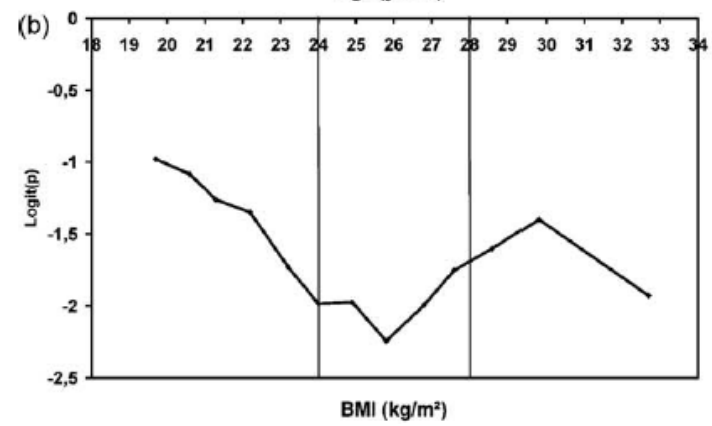
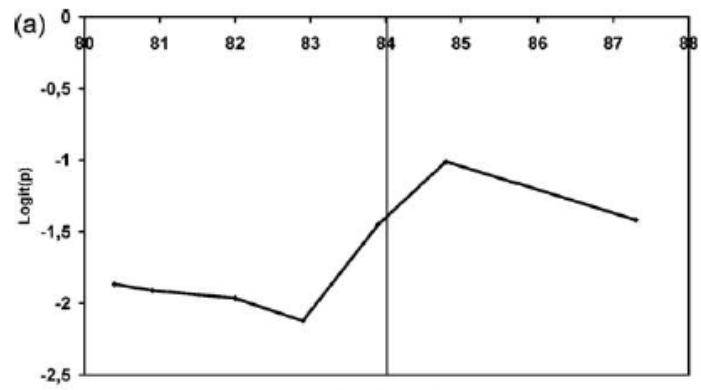
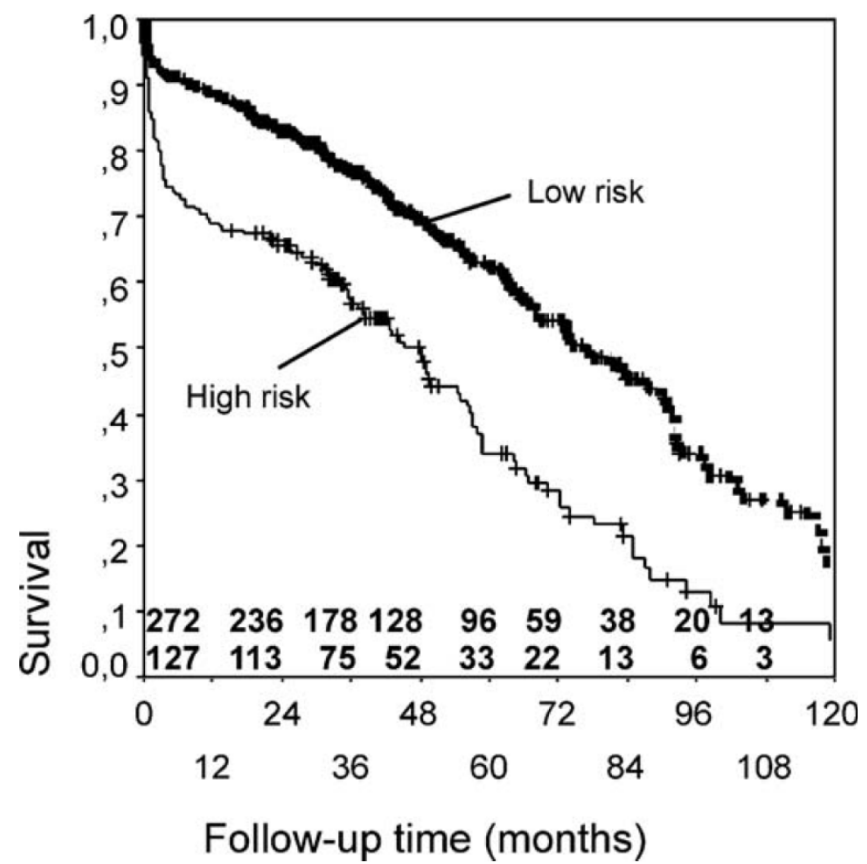
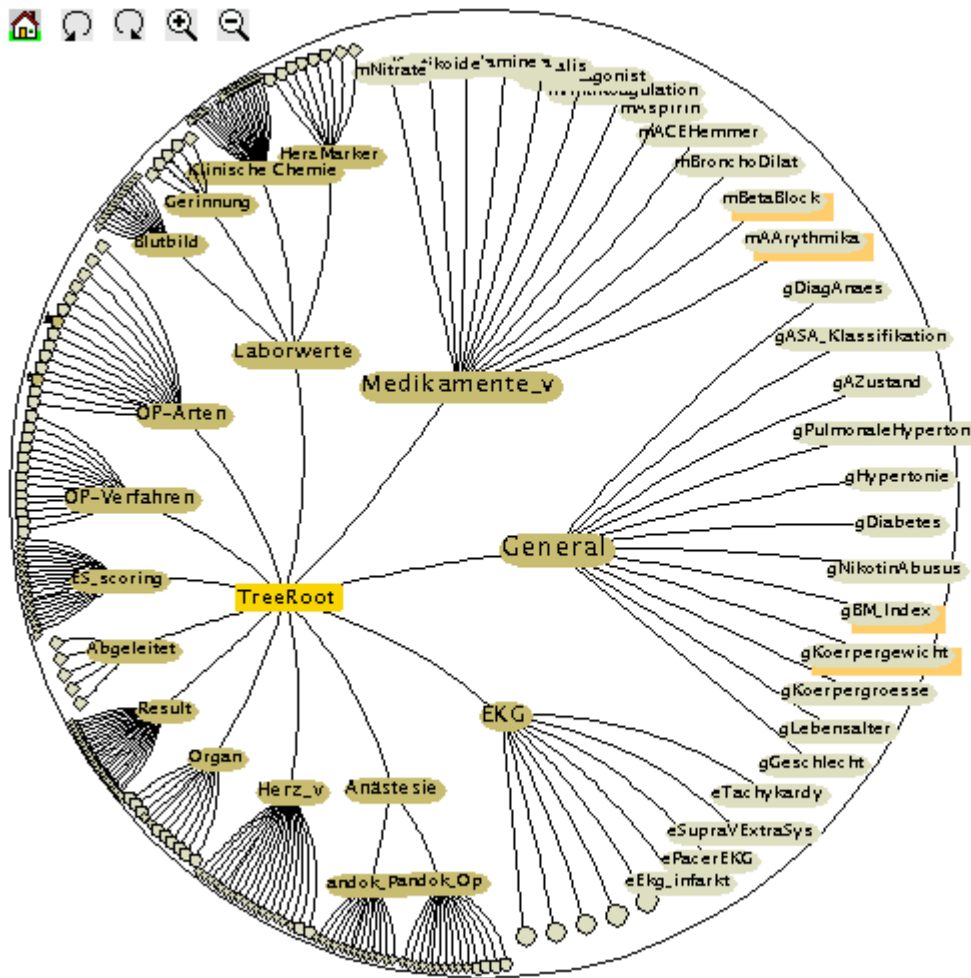


Table 3

Observed and predicted 30-day mortality by the presented risk model and by STS and EuroScore for high and low risk patients. .

	<i>N</i>	30-day mortality			
		Observed	Predicted by present model	Predicted by STS score	Predicted by EuroScore
High risk group					
Isolated AVR	95	11.6%	12.7%	8.7%	23.6%
AVR + CABG	90	14.4%	13.3%	9.6%	28.3%
Low risk group					
Isolated AVR	156	5.1%	5.8%	7.2%	17.8%
AVR + CABG	151	6.6%	5.8%	8.0%	17.9%





Search <Select>

- gBM_Index
- gKoerpergewicht
- mBetaBlock
- mAArythmika
- gDiagnoses
- gASA_Klassifikation
- gAZustand
- gPulmonaleHypertonie
- gHypertonie
- gDiabetes
- gNikotinAbusus
- gBM_Index
- gKoerpergewicht
- gKoerpergroesse
- gLebensalter
- gGeschlecht
- eTachykardie
- eSupra/ExtraSys
- ePacerEKG
- eEkg_infarct

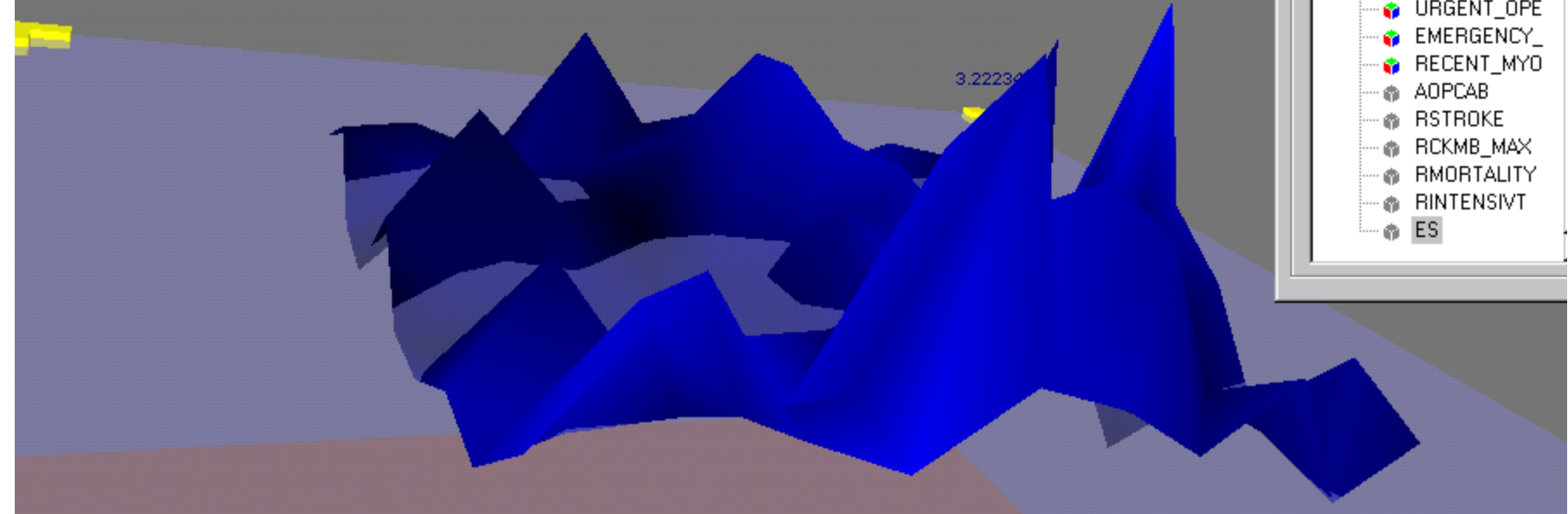
Navigation buttons: Home, Left Arrow, Right Arrow, Double Left Arrow, Double Right Arrow, Clear

<Abbrechen> <OK>

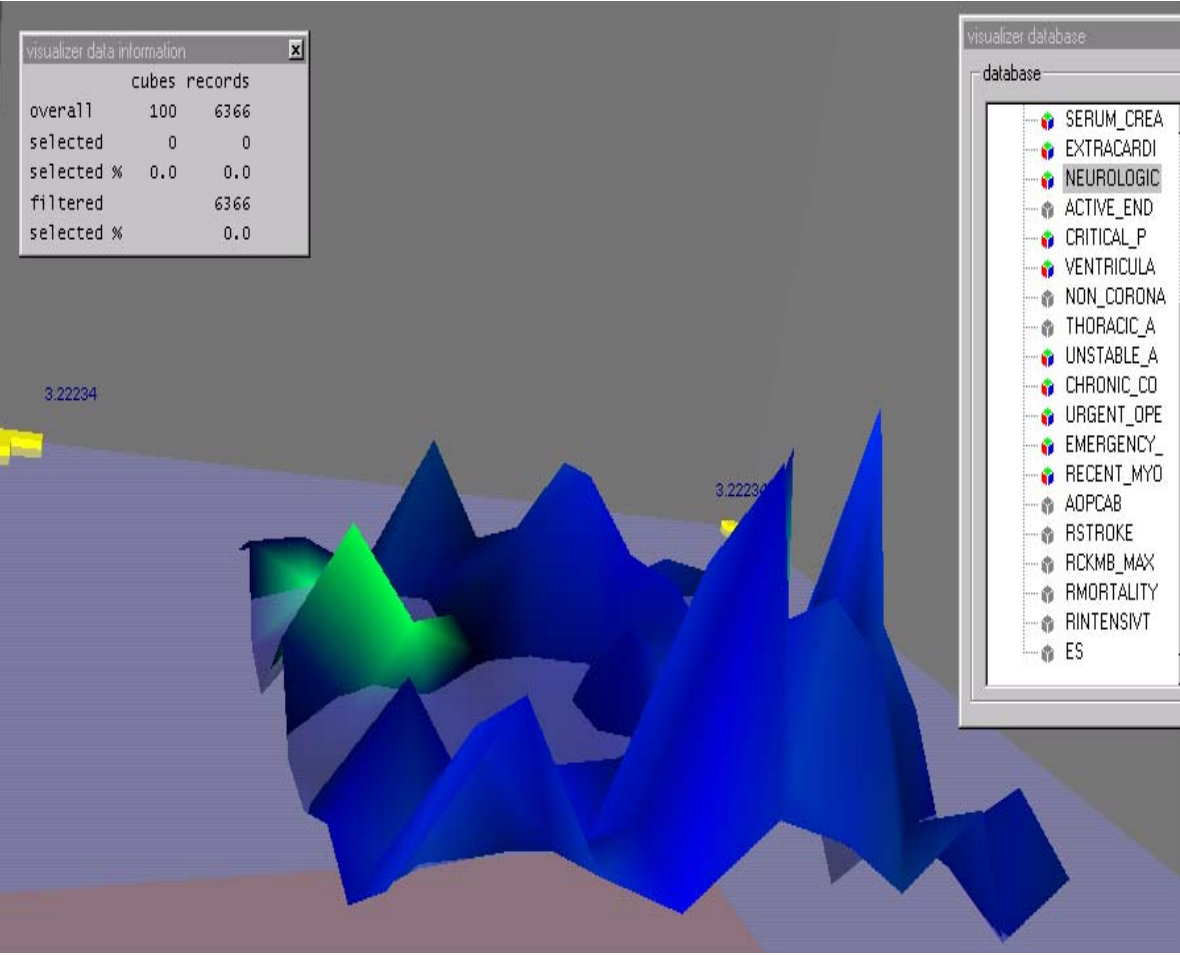
visualizer data information

	cubes	records
overall	100	6366
selected	0	0
selected %	0.0	0.0
filtered		6366
selected %		0.0

3.22234



- visualizer database
- database
- SERUM_CREA
 - EXTRACARDI
 - NEUROLOGIC
 - ACTIVE_END
 - CRITICAL_P
 - VENTRICULA
 - NON_CORONA
 - THORACIC_A
 - UNSTABLE_A
 - CHRONIC_CO
 - URGENT_OPE
 - EMERGENCY_
 - RECENT_MYO
 - AOPCAB
 - RSTROKE
 - RCKMB_MAX
 - RMORTALITY
 - RINTENSIVT
 - ES



visualizer data information		
	cubes	records
overall	100	6366
selected	0	0
selected %	0.0	0.0
filtered		6366
selected %		0.0

- visualizer database
- database
- SERUM_CREA
 - EXTRACARDI
 - NEUROLOGIC
 - ACTIVE_END
 - CRITICAL_P
 - VENTRICULA
 - NON_CORONA
 - THORACIC_A
 - UNSTABLE_A
 - CHRONIC_CO
 - URGENT_OPE
 - EMERGENCY_
 - RECENT_MYO
 - ADPCAB
 - RSTROKE
 - RCKMB_MAX
 - RMORTALITY
 - RINTENSIVT
 - ES

