



The University of Manchester Research

### Monitoring performance of cardiac surgery: the SCTS governance programme

#### Link to publication record in Manchester Research Explorer

### Citation for published version (APA):

Hickey, GL., & Bridgewater, B. (2013). *Monitoring performance of cardiac surgery: the SCTS governance programme*. SCTS Annual Meeting and Cardiothoracic Forum, Brighton, UK.

#### Citing this paper

Please note that where the full-text provided on Manchester Research Explorer is the Author Accepted Manuscript or Proof version this may differ from the final Published version. If citing, it is advised that you check and use the publisher's definitive version.

#### **General rights**

Copyright and moral rights for the publications made accessible in the Research Explorer are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

#### Takedown policy

If you believe that this document breaches copyright please refer to the University of Manchester's Takedown Procedures [http://man.ac.uk/04Y6Bo] or contact uml.scholarlycommunications@manchester.ac.uk providing relevant details, so we can investigate your claim.





# Monitoring performance of cardiac surgery: the SCTS governance programme

**GL** Hickey<sup>1</sup>; R Cosgriff<sup>2</sup>; B Bridgewater<sup>1,2,3</sup> <sup>1</sup>Northwest Institute of Bio-Health Informatics; <sup>2</sup>National Institute of Cardiovascular Outcomes Research; <sup>3</sup>University Hospital of South Manchester

> Part of this research was funded by Heart Research UK [Grant Number RG2583]

## Background

### The Guardian

#### NHS heart surgery

#### The data explained 244 doctors and the problem of comparing mortality rates

Figures on mortality rates are collected and analysed in various ways by different heart units in hospital trusts around the country, making it individual heart surgeons. The second second second second units were able to give "naw" mortality data for surgeons who do bypass operations – number of cases, and number and percentage of those and yoing. But those figures tell	highest rates, because they operate on those closest to death and with the most to gain from surgery. So we requested three years of risk-adjusted data for the commonest operation, asking trusts to group each surgeron's cases into low visk and high risk according to a fairly widely used system, EuroSCORE, acheck-list of a patient's risk factors for surgery: risk acts of his or	Following the example of four trusis in the north-west who published their results in the British Medical Journal, we acked heart units to split cases into low risk of five points or fewer, and high Surgroun diagree, some- times strongly, over how best to assess risk and therefore how to present death rates. Some say the north-west trusts have nor risk-adjusted, but only risk-attratified,	cases. Pupworth and St George's in London are among those who prefer logistic EuroSCORE, which gives a more complex computer value for each risk factor. Com units use the older Parsonent system, which also gives a value for each factor, but is now generally thought to over-estimate chances of a death, which some think make a surgeon's results look before than with EuroSCORE.	risk additive EuroSCORE, logistic EuroSCORE, Parsonnet, no available risk- adjusted data, and those trusts with risk-adjusted data on their weblets or available at the hoopital which is too simple tabulate form. A very important factor in assessing any surgeon's death rate is the number of cases he or she has done. Some specialise in operations other than bypass, such as mitral	hypasses in emergencies. Few deaths in few operations gives a worse mortality rate than few deaths in many operations. On a graph using 95% confidence intervals, which surgrow is within the acceptable limits laid down by the Society of Cardiothorack Surgeons. Athough the surgeon operating or supervising the operation is responsible for	Including pre- and post- operative care and anaethesia. All hospitals investigate deaths in surgery to see how the whole team can learn. We checked all which upplied them, and invited rouments from the individual argregens. Many emphasised the care that must be taken in drawing conclusions. Some had specific points.	surgery (for instance, brain damage) could be better indicators. Some were concerned publication could lead to risk-averse behaviour, with surgeous aroiding more disputed data their trust supplied for them. Others said they would have liked longer to peruse the paperwork themselves and check.
dying. But those figures tell very little. Sometimes the best surgeons have the	surgery: age, state of his or her heart, and so on. Each factor scores a point.	but only risk-stratified, which does not allow for the complexity of some high risk	better than with EuroSCORE. The data on this page are split in five groups: high/low	than bypass, such as mitral valve surgery, and may do only a few, more difficult	operation is responsible for its outcome, a death can be due to many factors,	Some had specific points, arguing that other markers such as morbidity during	Some of their individual comments will be found on the Guardian website.
best surgeons have the	factor scores a point.	eomptexity of some high risk	split in five groups: high/low	onty a tew, more difficult	due to many factors,	such as mortuality during	the Guardian webs

Coronary Artery Bypass Graft

Risk adjusted dat	a (EuroSCOR	EuroSCORE)										Hespital			Surger	Surgeon Cases Deaths %					Cases Deaths %			Righ risk Cases Deaths %		
Hospital		Surgeon	Tut Cases	al Deaths	5	Low	risk Deaths		Hig	p risk Deaths		St Mary's Hospita	4		Casuli	internet.	437 449	10	2.3	215 187	2	0.9	86 73	5	5.8	
Blackpool Victoria Hospita		Au	425	5	1.2	349	1	0.3	76	4	5.3	South Mancheste	r Universit	ies	Bridge	mater	258	3	1.2	223	2	0.9	35	1	2.9	
		Miner	503	11	2.2	419	5	1.2	84	6	7.1				Camp	bell	290	5	1.7	248	2	0.8	42	3	7.1	
		Soglari**	280	1	0.4	229	1	0.4	51	0	0				Ноори	ir .	266	1	0.4	247	1	0.4	19	ō	0	
Brighton & Sussex Universi	ty Hospitals	Cohen Forsyth	140 461	4	2.9	120 381	1 8	0.8 2.1	20 80	3	15				Water	worth	386	6	1.5	330	4	1.2	40 56	2	3.6	
		Hyde	389	7	1.8	338	2	0.6	51	5	9.8				Yonan		388	3	0.8	323	2	0.6	65	1	1.5	
Confighteenic Contro I ha	-	Chalanas	507	12	2.5	305		1.2	112		2.0	University Colleg	e London H	lospitals Trust	Hayns Kallist	ard :	229 108	5	2.2	201 101	4	2 0	28 7	0	3.6	
Cardiologia de Cante Ente	a poor	Dihmis	567	8	1.4	469	4	0.9	98	4	4.1				Keogh	enter de la composition de la	33 373	1 12	3 3.2	26 313	1 4	3.9 1.3	7 60	0	13.3	
		Fabri Griffiths	308 293	8	2.6 3.8	252 230	6	2.4	56 63	2	3.6				Lawre	nce	379	4	1.1	313	2	0.6	66	2	3	
		Mediratta	488	8	1.6	412	4	1	76	4	5.3				Soglia	m <sup>-</sup> *	97	4	4.1	83	1	1.2	14	3	21.4	
		Pullan	513	8	1.6	406	3	0.7	107	5	4.7				Van D	a t com**t	ů.	ő	ő	ô	0	0	0	0	0	
		Rashid	371	9	2.4	290	5	1.7	81	4	4.9				Waters Yap †	by	404 206	10 3	2.5	349 177	6	1.7	55 29	4	7.3	
лазов на нозрела		Guvendik	529	ŝ	1.5	478	4	0.8	51	4	7.8	University Hospit	al of Wales		Amer		100	2	2	72	1	1.4	28	1	3.6	
		Cowen Griffin	328 607	7	2.1	262 456	3	1.2	66 151	4 6	6.1				Butch	art	71	1	1.4	54	1	1.9	17	ő	0	
Coventry and Warwickshin	Trust	Ehabrat	86	2	2.3	66	1	1.5	20	1	5				Hayat Kulatil	t ake	217	2	0.9	179	0	0	38	2	5.3	
		Brilla <sup></sup> Dimitri	264 352	9	3.4	209	4	1.9	55 55	5	9.1 9.1				Mehta O'Kee	α fe	90 251	1	1.1 5.6	63 196	6	3.1	27 55	1 8	3.7	
		Norton	321	3	0.9	264	ō	ō	57	3	5.3				von Or	Isqu	241	3	1.2	160	1	0.6	81	2	2.5	
		Patel Rosin	231 282	2	0.9	171 232	2	0.9	60 50	2	3.3	University of Nor	th Stafford	shire Treat	Ahide		340	3	0.9	288	0	0	52	3	5.8	
Guy's and St. Thomas' Hosp	pital	Anderson**	235	5	2.1	214	4	1.9	21	1	4.8				Levine		612	15	2.5	524 346	8	1.5	88 54	7	10	
		Austin Riveth	276 292	3	1.1	242	3	1.2	34	0	67				Ridey		307	1	0.3	275	0	0	32	1	3.1	
		O'Riordan	519	6	1.2	433	4	0.9	86	2	2.3				Satury	peice	411 429	5	1.2	329	3	0.9	82 76	4	5.3	
		Moeburgh Shabbo	349 416	6 9	1.7	279 334	4 5	1.4	70 82	2 4	2.9 4.9	Risk adjust	ted data	a (Parsonnet	)											
		Venn Young	235 228	1	0.4	153 175	0	0.6	82 53	1	1.2	Hospital			Surger	an .	Tota	Deaths		Low ri Cases	ak Deaths	5	High Cases	risk Deaths	*	
John Redcliffe		Arristead	271	5	1.8	206	2	1	65	3	4.6	Royal Brompton	and Harefa	ild Hospital	Amran De So	11 11.2.8	647 660	12 6	1.9	465 440	4	0.9	182 220	8	4.4 2.3	
		Pilai	192	9	4.7	142	2	1.4	50	7	14				Drayfs Gaer	167	199 294	5	2.5	129 193	1	0.8	70 101	4	5.7	
		Taggart	340	12	3.5	262	4	1.5	78	8	10.3				Khaga	ni	359	13	3.6	257	5	1.9	102	8	7.8	
		Westaby	112	3	2.7	81	2	2.5	31	1	3.2				Peppe	r	367	15	4.1	235	3	1.3	132	12	9.1	
MRI Manchester Heart Cer	tre	Grotte Hasan**	362 413	2	1.9	311 349	5	1.6	51 64	2	3.9 1.6				Sarka	6	446	3	0.7	319	1	0.3	127	2	1.6	
		Keenan McLauphin	328 41	6	1.8	275 36	3	1.1	53	3	5.7	Biskarium	ed data	Mean Fure	Tadjki Stefelo <sup>24</sup>	i i i i i i i i i i i i i i i i i i i	255	6	2.4 EG 107	207	3	1.4	48	3	6.2	
		Odom	337	9	2.7	286	5	1.7	51	4	7.8	and a second sec		Total		Confidence	Ave %	102/4			T	letal	Ca	fidence	Ave %	
Research Manufactor Terror		Also	430	14	3.4	3/5	2	1.9	03	2	26	Papworth	Dunning	224 5	2.23	0.72-5.21	3.82	Sheffiel	Id	Billingt	50	1	2 0	1-12.0	-dicted 3.7	
r symmetri medpitalis i rust		Dalrympie-Hay	401	9	2.2	315	3	1	86	6	7		Jenkinis Large	320 8	2.5	1.08-4.93	5.07	reachin	2	Cooper	306	4	1.3	0.4-3.5	3.1	
		Kuo Lewis	202 141	3	1.5 1.4	160 108	1	0.6	42 33	2	4.8		Nashef Ritchie	409 3 502 15	0.73 2.99	0.15-2.14 1.67-4.93	4.33			Hopkinson Kolocasside	324 187 158	4	1.2 1.3	0.4-3.3	2.3	
		Marchbank Unsworth-White	487 997	8	1.6	342	2	0.6	145	6	4.1		Rosengard* Tsui	1 44 0 393 6	0	0-8.38	3.04			Matuszewsk Sarkar***	ut 73 315	1	1.4	25-3.0	3.2	
Royal Victoria Hospital		Graham**t/	144	4	2.8	112	0	0	32	4	12.5		Walwork Wells	228 4 57 4	1.75 7.02	0.48-4.49	3.05			Wilkinson Locka	263 325	1 3	0.4	0.0-2.5	2.8	
							-	_						-							-	_				
Non risk adjusted	data (adjusti	ed data on webs	iite)	South	armpton U	niversity	Barlov	v	173	2 2	1.2	nospital		Kirk	279	9	3.2	nospita	21		Gladate	on tet	130	3	2.3	
Bristol Royal Infirmary	Amer" "†	105 3	2.9	WEBS WWW.52	ETE dt.rht.uk/ technisciest-	1058	G Tsar Haw	·a	231 139	8	5.8			Lund *** MacAurthur	46 238	2	4.3				Lund** MacGo	t wang	117 187	4	0.8 2.1	
weesite www.ubit.ths.uk/	Angelini Ascionet	3U3 1 181 2	0.3	met.C			Langle	ay V	170 210	4	2.4 3.3			Murday Neare	336 467	9 12	2.7	South Te	iees Hos	pital	Hunter	-	380	13	3.42	
harreport/ ACSAR2003-04.PDF	Bryan	392 6 31 0	1.5				Monro		216	7	3.2			Pathi	465	7	1.5				Kendall		577 434	10	1.73	
	Casula" **	38 1	2.6	_			Sunde	rt	11	1	9.1			Wheatley	73	î	1.4				Owens		266	1	0.38	
	Hutter	412 8	1.9	Nor	n risk a	djustec	data					Hammeramith Ho	spitals	Anderson**	346	6	1.8				Walks		470	5	1.06	
	Pawade	59 1	1.7	Aberd	deen Royal	Infirmary	2		455 349	9	2 2.6			Hornickt	14	õ	0	St Mary	/'s Hospi	tal	Genvil	ef	415	14	3	
	Underwood	238 3	1.3				3 41		329 103	23	0.6			Smith**	293	8 9	2 3.1	Swanse	a Trust		Argano		292	1	0.3	
kings Cellege Hospital WEBSITE	Desai	6/ 2 271 7	2.6	_			51		166	4	2.4			Taylort	131	7	5.3				Youhan		471	7	1.5	
www.kingsch.nhs.uk	Lleshpande El Garrel	96 1 259 2	0.8	Barts	& the Lon	don Hospit	abs Awadt Bahna	ni***	171 37	1	0.6	Leeds Teaching H	ospital	Kay	62b 426	6	1.4	(below )	iter Manar 14	d Risselan'	Zaidit		153	0	0	
	brahim John	99 2 343 3	0.9				Edmon	ndson	130 348	1	0.8			McGoldrick Munsch	393 285	11	0.2	JINNERSI	ng mespit	- Jerninghui	Graham		306	5	1.6	
	Marrinan	268 9	3.4				Mager	a Gal	184	2	1.1			Nair O'Renan	398 528	1	0.2				Keogh* Mascar	101	193 75	6 2	3.1 2.7	
Newcastle Upon Tyne	Hasan"† Toronir#	55 0 324 3	0.9				Uppal	-	227	5	2.2			Van Doorn**†	35	ő	0				Pagano		358	5	1.4	
www.newcastle- hosaitais.nhs.uk/	Clark	272 4	1.5				Wer Wong		297	3	1.7			Weerasenat	0	ő	ő				Wilson		378	3	0.8	
cardiq/index.axp	Farty	291 9	3.1	-			Wood		237	7	2.9	Lothian University	Hospitals	Brackenbury	313	10	3.2				Galinan	-	280 307	4	1.4	
	Hilton	24 2 281 13	2.1 4.6	City H	tospital No	Congham	Birdit Mitche	4	239 302	3 5	1.3 1.6			Campanella	282	4	1.4				Hadjinik Hickey	kolaou	442 355	1	0.2	
	Ledingham Pillay	301 6 386 9	2.3				Nak Richar	15	306 216	8	2.6 1.3			Mankad O'Toolet	213 115	2	0.9				Levern	nent.	149	1	0.7	
	Schuelert	213 8	3.8	North	Glasgow	Iniversity	Berg	-	431	9	2.1			Pessettor	94 340	1 4	1.1				Spyt		308	5	1.6	
St George's Hospital WEBSITE	Chandrasekara Jahanziri	n 533 5 575 10	0.9		-		Butler Colve	houn	414 313	8	1.9 1.6			Walker	91	i	1.1	NOTES								
www.st-georges.org.sk/ Cardiacindex.asp	Kanagasabay Sarsam	424 5	1.2				Craig		331	9	2.7	Reval Victoria He	unital	Campalaria	184	5	3.1	†Notthe "Surgeo	full three ; on worked	ears. at now than o	w hospital					
	Smith**	315 5	1.6				Faiche	wy	305	11	3.6	noya victoria no		Danton"*	93	4	4.3	- Surgeor	ns own fig n question	ures is whether data	fully reflec	ts caselos	ad over three y	an.		

# BMJ Helping doctors make better decisions

*BMJ* 2005; 330 doi: 10.1136/bmj.330.7490.506 (Published 3 March 2005) **Cite this as:** *BMJ* 2005;330:506

Mortality data in adult cardiac surgery for named surgeons: retrospective examination of prospectively collected data on coronary artery surgery and aortic valve replacement

Ben Bridgewater on behalf of the adult cardiac surgeons of north west England

Publishing mortality rates by named hospital and consultant since 2001 and 2005 respectively

## The flow of data



### Data preprocessing

- The registry is cleaned:
  - transcriptional, numerical, temporal & clinical errors resolved
  - duplicate and non-cardiac records removed
- The data is filtered:
  - operations between 1<sup>st</sup> April 2008 & 31<sup>st</sup> March 2011
  - exclude transplantations; trauma; primary VADs
  - exclude minors (<18 years)</p>
  - exclude private hospitals
  - exclude emergency & salvage procedures

# **Risk-adjustment**

- Necessary to riskadjust outcome measures
- Old models, e.g. logistic EuroSCORE, are miscalibrated
- Would lead to all units being identified as below the target



# **Risk-adjustment**

### • Build a new model

- incomplete data
- procedure specific?
- Refit existing model
  - does not fit contemporary cohort well
- Recalibrate existing model
  - only adjusts for single variable
- Other options...



**Goodness-of-fit**: Hosmer-Lemeshow *P* = 0.56 **Discrimination**: AUC = 0.78

# Defining divergence

- Funnel plot methodology
- Confidence intervals used to classify 'outliers'
- For consultant-level analysis we adjust for multiple comparisons (when making comparisons of many surgeons, high probability of identify ≥1 'outlier' due to chance)
- Standard errors are inflated due to observed over-dispersion (greater variability than expected by the binomial model)



### **Results: hospitals**



### **Results: consultants**



# Conclusions

- Identifying 'outlier' healthcare providers is methodologically (and politically) challenging
- Combining clinical and analytical expertise can reduce errors in classification
- An 'outlier' does not necessarily imply poor practice; can be attributable to data quality or case mix
- Future analyses to explore using more sophisticated statistical methodology