# Risk Prediction in Cardiac Surgery

To Operate or Not — SAAPM Seminar

Government of the Control of th

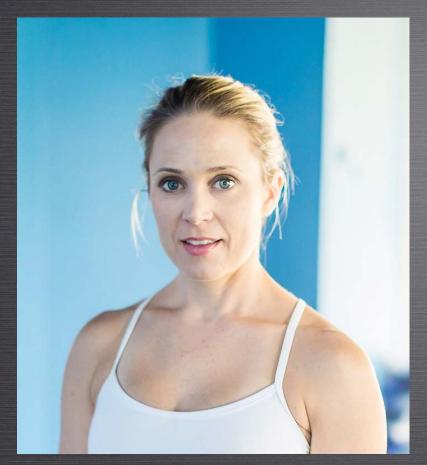
23 July 2015



**Greg Rice Cardiac and Thoracic Surgery Flinders Medical Centre** 

### Risk Prediction Scores

- Huge degree of variability in perioperative risk
- Raw outcome measures poor markers of quality
- Scores developed for risk prediction; also used for risk adjustment for outcome measures
- Now widely used in public reporting of risk-adjusted outcomes (SCTS, New York State, others)



- 40 year-old
- Mitral regurgitation
- No other medical issues
- Normal LV function



- 85 year-old
- Aortic stenosis
- Previous CAG
- Moderate LV dysfunction

### Risk Prediction Scores

- Huge degree of variability in perioperative risk
- Raw outcome measures poor markers of quality
- Scores developed for risk prediction; also used for risk adjustment for outcome measures
- Now widely used in public reporting of risk-adjusted outcomes (SCTS, New York State, others)

## Risk Prediction Scores

- Early Parsonnet, Cleveland Clinic, French, Pons, Ontario
- EuroSCORE (I and II)
- STS Predicted Risk Calculator
- Others TuScore, AusScore

## **Early Scoring Systems**

Name	Year	Type	No. of Patients
Parsonnet	1989	Single centre, retrospective	3,500
Cleveland Clinic	1992	Single centre, retrospective	5,051
French	1995	Multi-centre, prospective	7,181
Pons	1996	Multi-centre, prospective	916
Ontario	1995	Multi-centre, retrospective	6,213





European Journal of Cardio-thoracic Surgery 16 (1999) 9-13

#### European system for cardiac operative risk evaluation (EuroSCORE)<sup>†</sup>

S.A.M. Nashef\*, F. Roques, P. Michel, E. Gauducheau, S. Lemeshow, R. Salamon, the *EuroSCORE* study group

Papworth Hospital, Cambridge CB3 8RE, UK

Received 21 September 1998; accepted 29 March 1999

#### **EuroSCORE**

- European System for Cardiac Operative Risk Evaluation
- Developed from data set of 13,302 patients September to December 1995; validated in 1,479
- Initially additive:

0–2 Low risk

3–5 Medium risk

6+ High risk

- Logistic score 2003
- Online calculator available at http://www.euroscore.org/calcold.html

#### **EuroSCORE**

#### **Patient Factors**

- Age
- Sex
- COPD
- PVD
- Neurological dysfunction
- Previous cardiac surgery
- Renal impairment
- Active endocarditis
- Critical preoperative state

#### Cardiac Factors

- Unstable angina
- LV dysfunction
- Recent MI
- Pulmonary hypertension

#### **Procedural Factors**

- Emergency
- Non-isolated CABG
- Thoracic aortic surgery
- Post-infarct VSD

#### **EuroSCORE II**

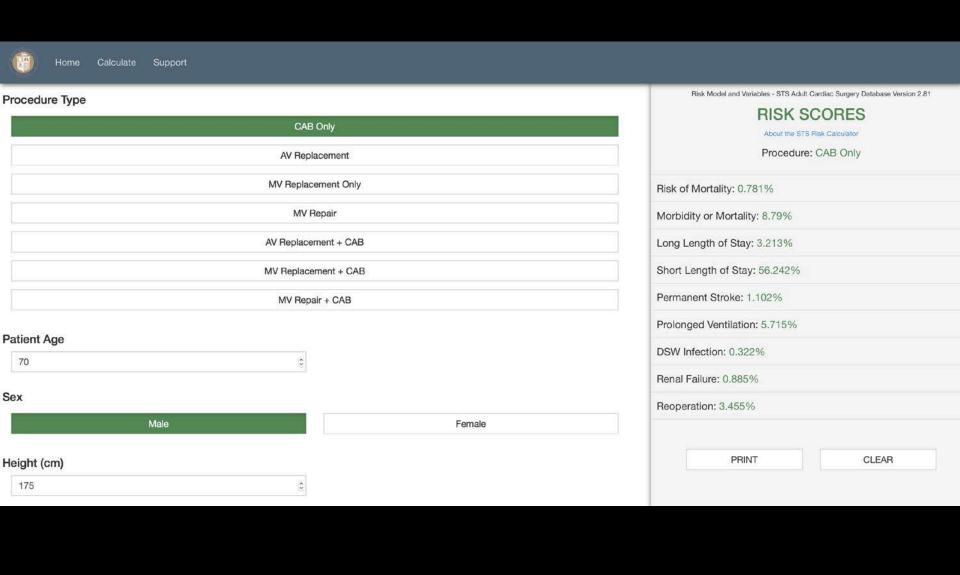
- Recognition that EuroSCORE overestimates risk
- Updated model, presented at EACTS meeting 2011
- 22,381 patients, May to July 2010; validated in 5,553 patients
- Adds 'poor mobility' & insulin-dependent diabetes, as well as more detail on functional status (NYHA & CCS classes)

### Limitations

- Risk factors determined by multivariate analysis
- Predominantly isolated coronary artery surgery
- Rare factors not incorporated into models but may represent significant increase in perioperative risk
- Multiple reoperations
- Liver dysfunction, coagulopathy
- Right ventricular dysfunction
- Weight (over or under)
- Arrhythmias
- Predicts mortality only, not morbidity

#### STS Score

- Society of Thoracic Surgeons Adult Cardiac Surgery Database
- Derived from data for patients undergoing surgery between 1 Jan 2002 and 31 Dec 2006 (60% development, 40% validation):
  - 774,881 isolated CAG procedures
  - 109,759 isolated valve procedures
  - 101,661 combined CAG & valve procedures
- Data used to determine risk of mortality, plus 5 morbidity outcomes (stroke, renal failure, reoperation, DSWI, prolonged ventilation) and prolonged length of stay
- Online calculator at http://riskcalc.sts.org



## STS Score

#### **Patient Factors**

- Age
- Sex
- Race
- Height, weight
- Renal failure
- COPD
- Cerebrovascular disease
- PVD
- Diabetes
- Hypertension
- Immunosuppression
- Endocarditis
- Critical preoperative state

#### Cardiac Factors

- Heart failure
- Unstable angina or MI
- Arrhythmia
- Valvular disease

#### **Procedural Factors**

- Non-elective
- Reoperative status

## Limitations

- Only predicts outcomes for certain procedures:
  - Isolated CAG
  - Isolated AVR
  - Isolated MVR
  - Isolated MV repair
  - CAG & AVR
  - CAG & MVR
  - CAG & MV repair
- Omits certain factors (liver dysfunction, coagulopathy, RV dysfunction, pulmonary hypertension)
- More complex

# An Australian risk prediction model for 30-day mortality after isolated coronary artery bypass: The AusSCORE

Christopher Reid, PhD,<sup>a</sup> Baki Billah, PhD,<sup>a</sup> Diem Dinh, PhD,<sup>a</sup> Julian Smith, MBBS,<sup>b</sup> Peter Skillington, MBBS,<sup>c</sup> Michael Yii, MBBS,<sup>d</sup> Seven Seevanayagam, MBBS,<sup>e</sup> Morteza Mohajeri, MBBS,<sup>f</sup> and Gil Shardey, MBBS<sup>b</sup>

The Journal of Thoracic and Cardiovascular Surgery • October 2009

## Case Example

- 60 year-old man
- Previous CAG, patent LIMA to LAD, occluded native coronary arteries, LVEF 18%, dual-chamber AICD in situ
- Reoperative MVR September 2014 with mechanical prosthesis
- Prosthetic valve endocarditis with S. epidermidis April 2015
- Now referred for redo MVR for severe paravalvular leak with recurrent heart failure on maximal therapy, with worsening renal failure (Cr 350)
- What is his risk?

## Case Example

EuroSCORE II

60.98%

STS

27.05%