

## Time Perception of 1 Minute



# ACHD and Intensive Care

Optimizing Outcomes

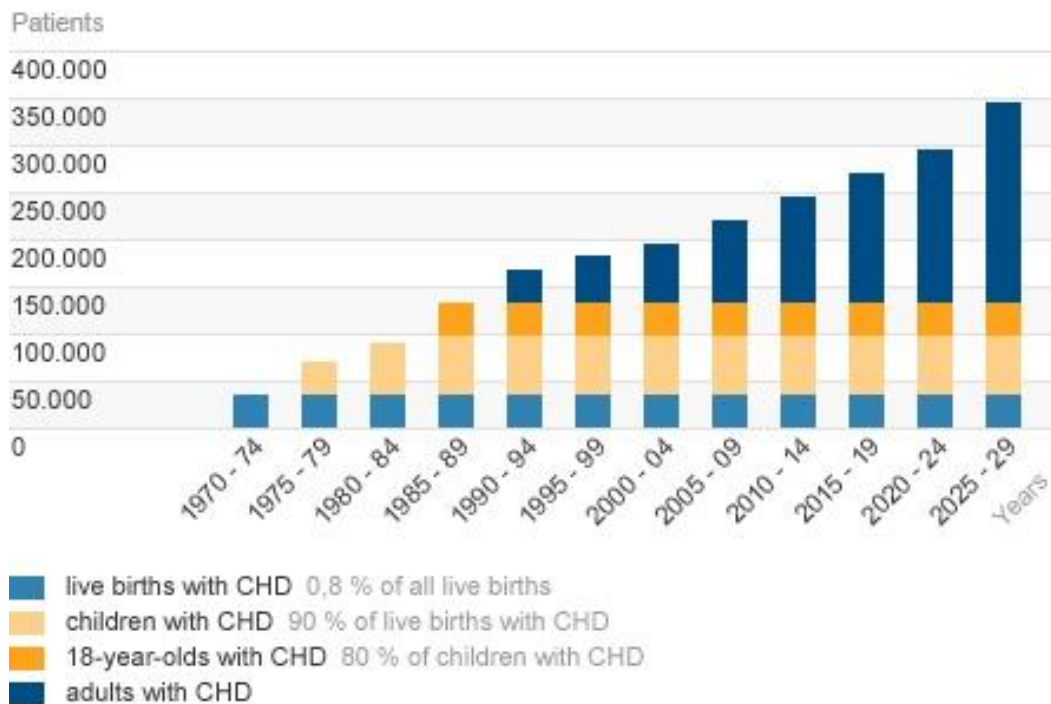
David Buckley PICU Starship Children's Health

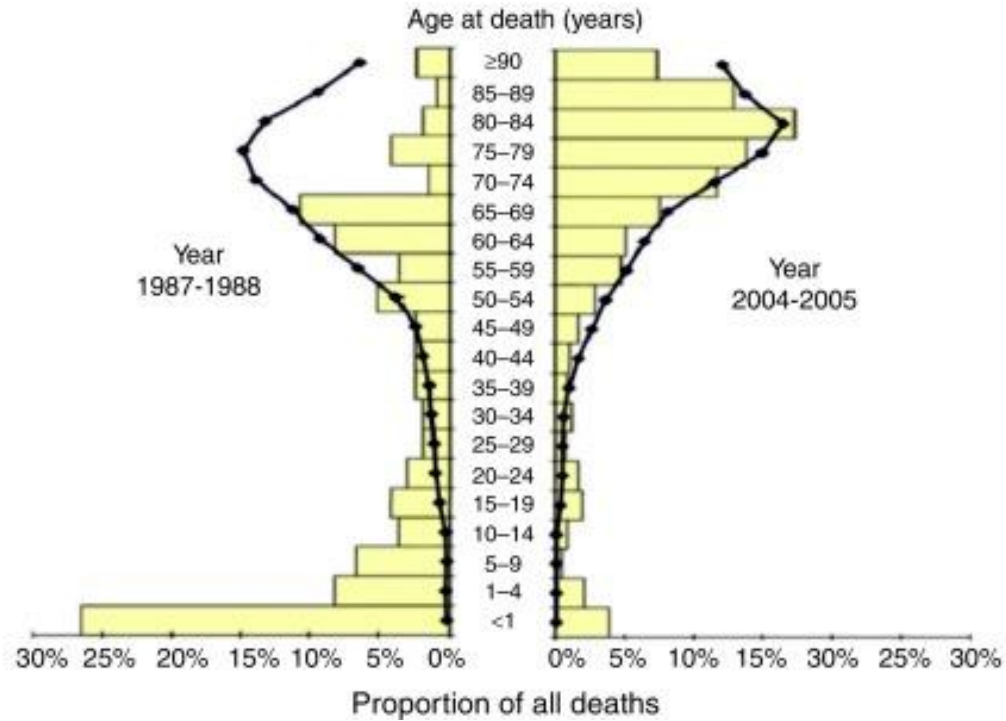


**Ask not what  
your ICU can do  
for you but  
what can you  
do for your ICU**



### Estimated clinical relevance of CHD in the next years





# Intensive Care Issues

- \* What are our goals for these patients when they come to Intensive Care ?
- \* Where should these patients receive Intensive Care ?
- \* What treatment can/should be provided ?

# What are our Goals ?

- \* Without knowing these you can not get a good outcome.
- \* Applicable to the service overall and the individual patient.
- \* Need commonality of purpose
  - \* Patient and Family
  - \* Cardiologist
  - \* Intensivist

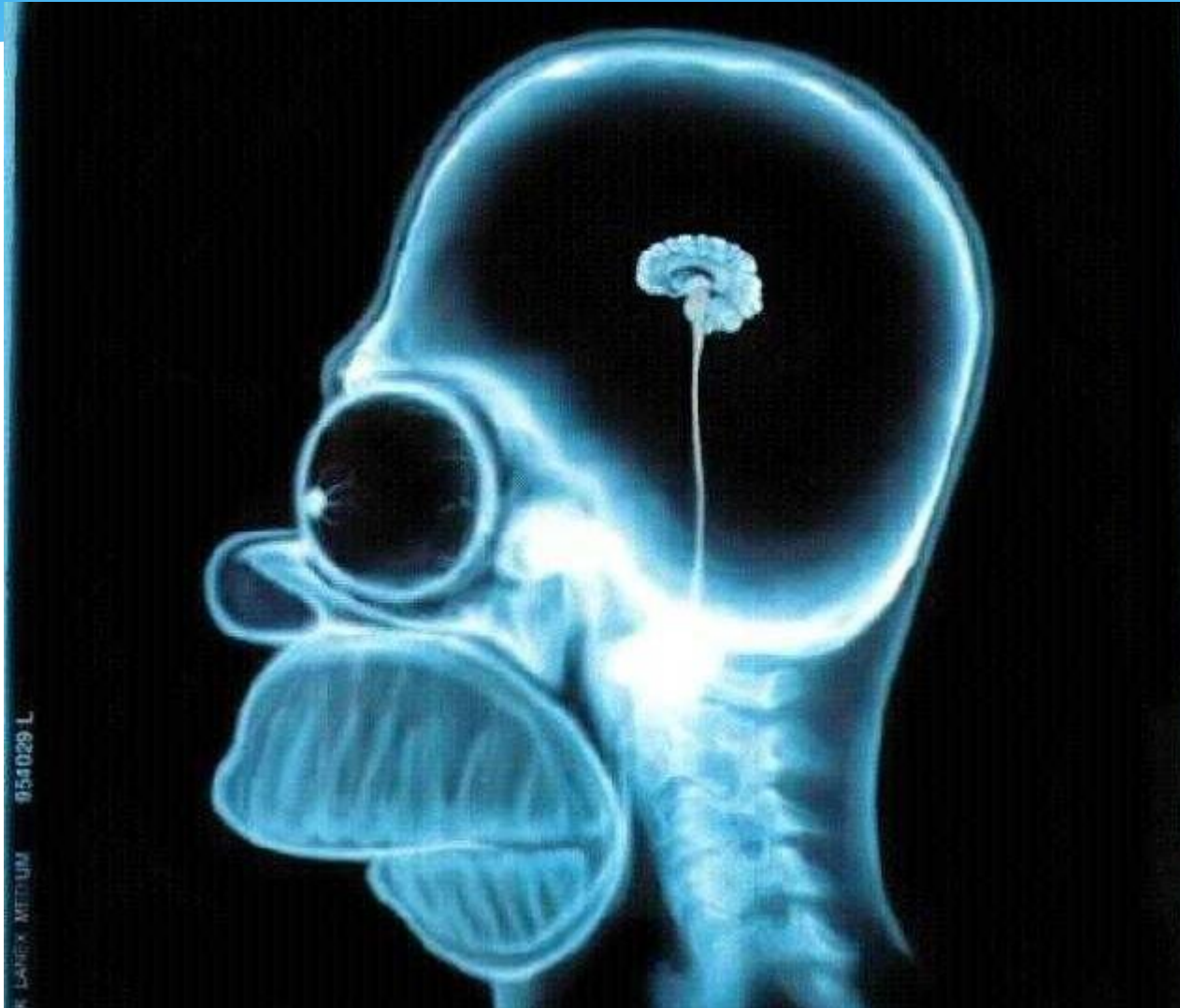




# What are the Goals ?

- \* Patient
  - \* Competence
  - \* Maturity
  - \* Expectations
- \* Cardiologist
  - \* Plan B
  - \* Treatment and Palliation
- \* Intensivist
  - \* Cure vs Treatment vs Palliation
  - \* Chronicity
  - \* Competence

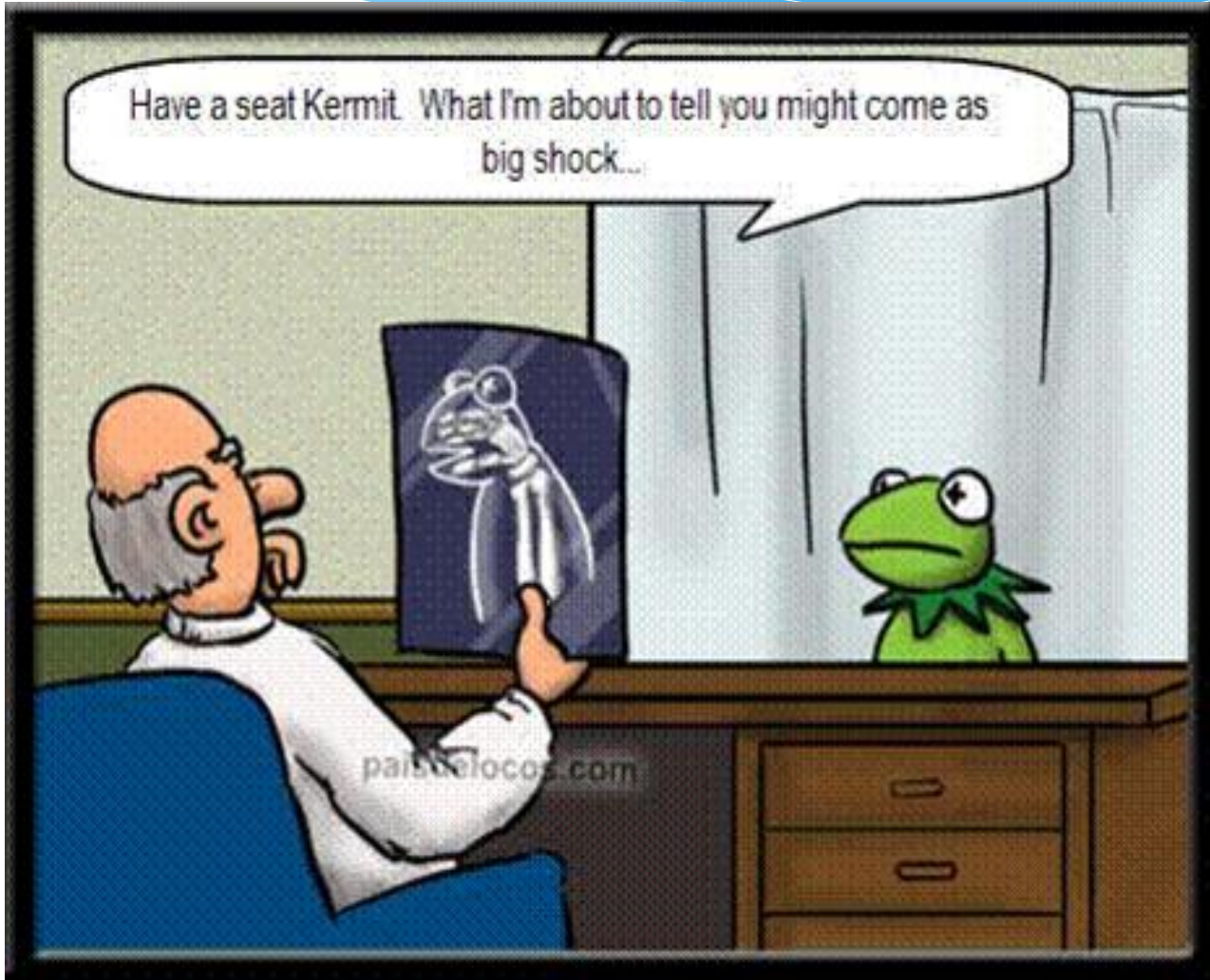
# Patient vs Cardiologist vs Intensivist



# Achieving the Goals

- \* Consistency of medical approach critical
- \* Close co-operation between all specialties and patient/family
- \* Anticipating patient trajectory
- \* Avoiding sudden changes in treatment

Have a seat Kermit. What I'm about to tell you might come as big shock...



# Where will these patients be treated

- \* Intensive Care services align with the treating physician/surgeon
- \* Adult vs Paediatric vs Mixture
- \* Depends on what is being treated

# Who treats them

- \* Intensivists with experience in adult congenital heart disease
  - \* Training
    - \* Paediatric or Adult
- \* ACHD surgeons and cardiologists
- \* Allied Health Services

# Problems - Medical

- \* Heart Failure
- \* Endocarditis
- \* Arrhythmia
- \* Pulmonary Hypertension
- \* Pregnancy
- \* Intercurrent illness



# Treatment

- \* Medical
  - \* Cardiac
    - \* Heart Failure
    - \* Arrhythmia
  - \* Respiratory
    - \* Positive pressure to support LV
  - \* Renal
    - \* Control of fluid balance with extracorporeal treatment

# Heart Failure

- \* Commonest reason for hospital admission
  - \* Single Ventricle
    - \* Timing varies with lesion
  - \* Systemic RV
    - \* ccTGA
    - \* Atrial Switch

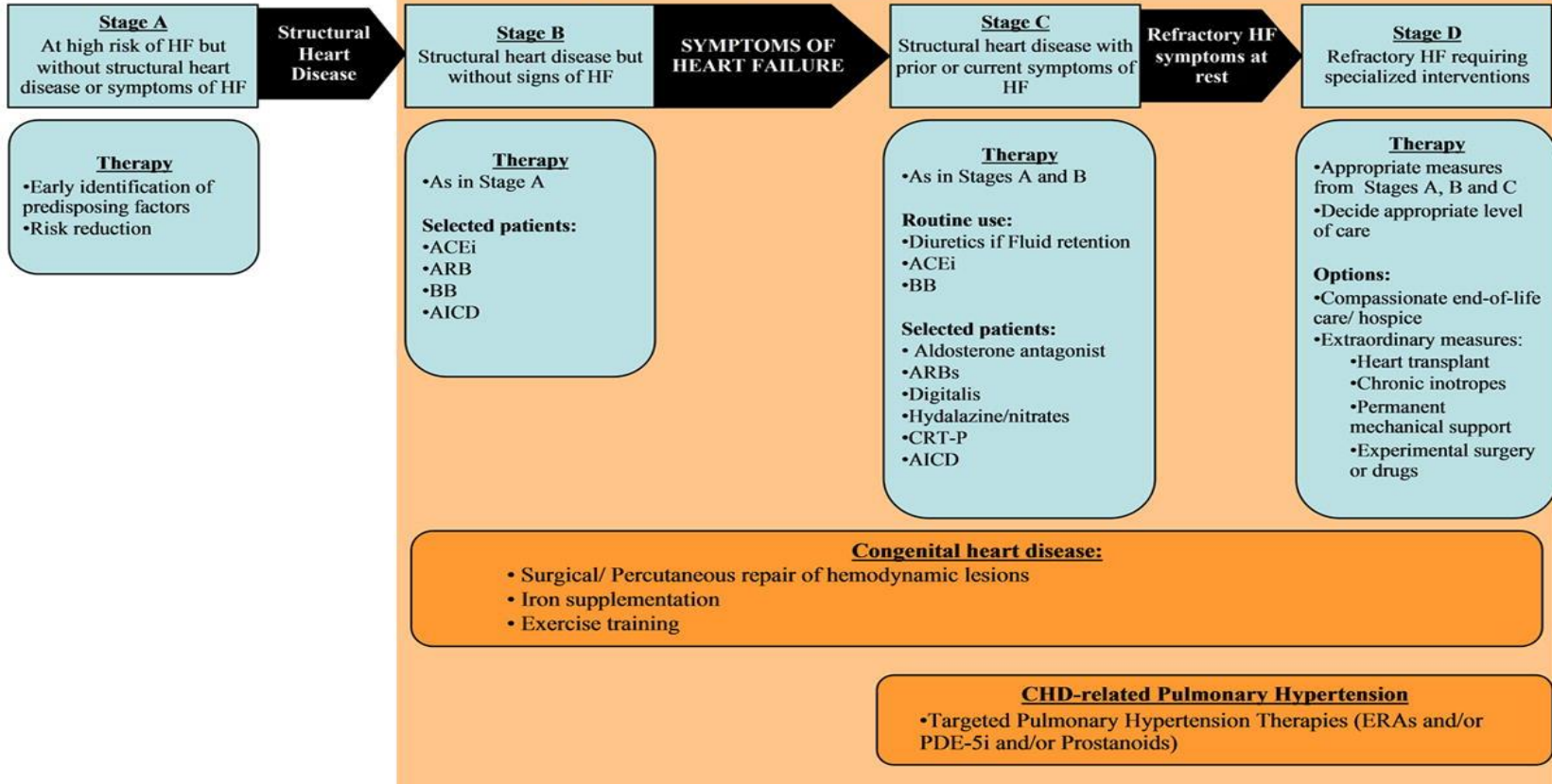
# Heart Failure

- \* Diuretics
- \* Afterload reduction
- \* Pulmonary Vasodilators in PAH
- \* Inotropic Support
- \* Mechanical Support

# CONGENITAL HEART DISEASE

## AT RISK OF HEART FAILURE

## HEART FAILURE



\* Stout K et al Chronic Heart Failure in Congenital Heart Disease  
Circulation 133(8) 770-801. Feb 23 2016

# Treatment of the Failing Circulation

- \* Beyond Antifailure Drugs
  - \* Inotropic support
  - \* Cardiac Transplantation
  - \* Extracorporeal Support
    - \* Temporary
    - \* Long Term

# Arrhythmia

- \* Subtle cause of CHF
- \* Need expert guidance
  - \* Drugs
  - \* Ablation techniques
  - \* PPM

# Pregnancy

- \* Pregnancy
  - \* Increasing numbers
  - \* Some require intensive monitoring +/- treatment especially around the time of delivery
  - \* Impact depends upon lesion
  - \* Hopefully preplanned

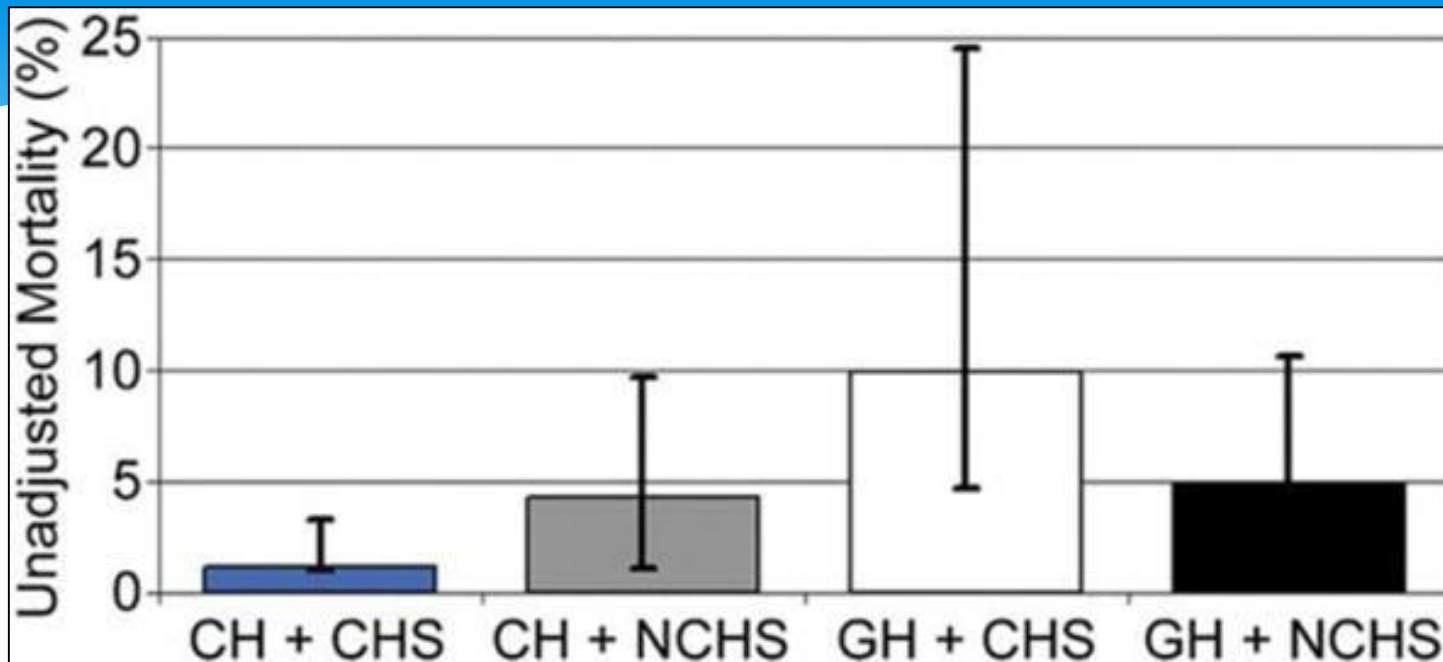
# Intercurrent Illness

- \* Increasing numbers
- \* Requires co-ordinated service
- \* Mainly adult based



# Post Operative Treatment

- \* Post Operative
  - \* Unpredictable course
  - \* Often redo surgeries
  - \* No good preoperative scoring system
    - \* Multiple Co-morbidities
    - \* Renal impairment is common
    - \* Arrhythmias

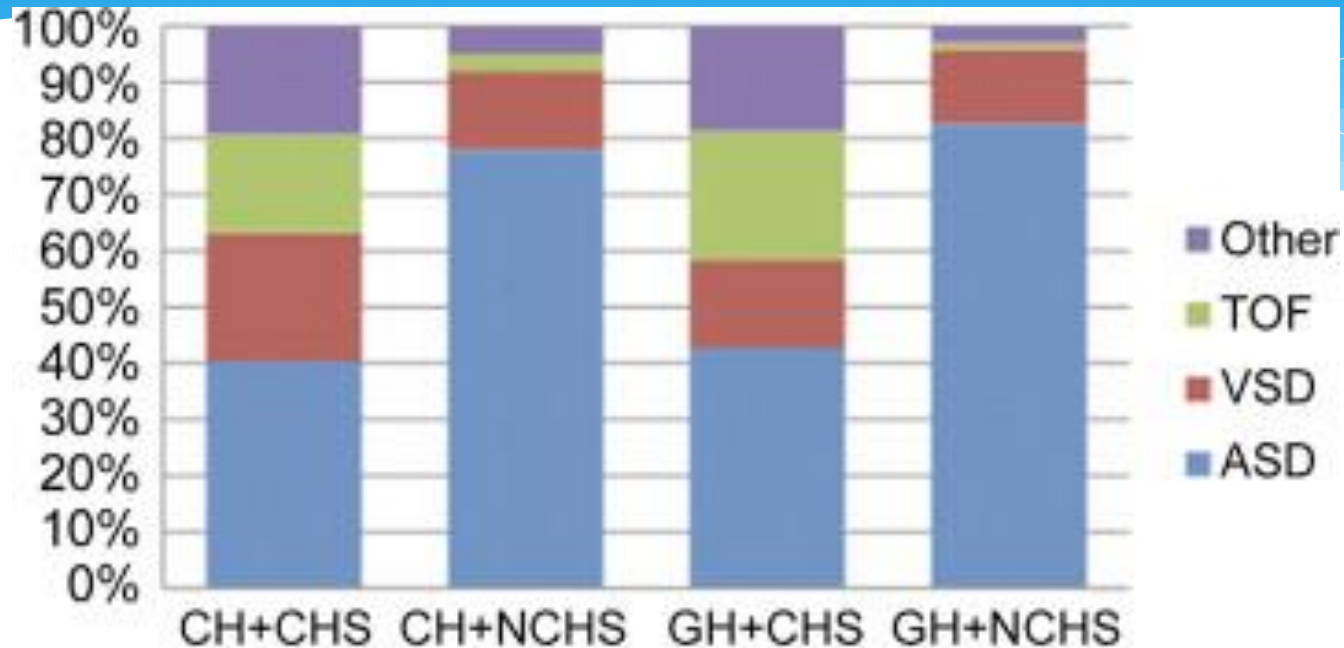


Estimated in-hospital mortality for grown-up congenital heart disease (GUCH) patients operated on within children's hospital (CH) and by congenital heart surgeons (CHS) was lower (1.1% [0.1% to 2.1%]) than for all other clinical environments, whereas estimated in-hospital mortality was highest for GUCH patients operated on within GH plus CHS (9.9% [5.3% to 15.7%];  $p = 0.001$ ). Examined by hospital type, there was a trend toward improved survival for GUCH patients operated on in CH compared with patients operated on in GH (3.9% [2.9% to 4.8%] versus 5.0% [4.2% to 5.7%];  $p = 0.06$ ). Accordingly, GUCH patients in CH plus NCHS had a small reduction in mortality (4.3% [3.3% to 5.4%]) compared with GUCH patients in GH plus NCHS (5.0 [4.2% to 5.7%];  $p = 0.35$ ), suggesting a possible benefit to the children's hospital environment.

**Annals of Thoracic Surgery.**

**Karamlou, Tara, MD; Diggs, Brian S., PhD... ; Ungerleider, Ross M., MD, MBA; Welke, Karl F., MD, MS.**

**Published August 1, 2010. Volume 90, Issue 2. Pages 573-579. © 2010.**



Case mix among the four clinical environments varied significantly. In general, the congenital heart surgeons (CHS) operating within either practice setting (children's hospitals (CH) or general hospitals (GH)) performed fewer atrial septal defect (ASD) repairs and more complex operations. On the other end of the spectrum, the noncongenital heart surgeons (NCHS) operating within either practice setting performed more than 80% ASD repairs with few complex procedures. (Blue sections = ASD; green sections = tetralogy of Fallot; red sections = ventricular septal defect; purple sections = other.)

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Variable	Pediatric Surgeon (n = 257)		Adult Surgeon (n = 46)		p Value
	No. of Patients	Mean ± SD	No. of Patients	Mean ± SD	
Patient factors					
<b>Age at surgery (y)</b>	28 ± 11.4		42 ± 14.6		<b>&lt;0.0001</b>
<b>Coexisting medical problems</b>	103 (40%)		33 (72%)		<b>0.0001</b>
<b>STS database defined risk factors</b>	50 (19%)		18 (39%)		<b>0.006</b>
Previous operations	189 (74%)		35 (76%)		0.857
Operative factors					
RACH score	2.06 ± 0.8		2.38 ± 0.7		0.024
Outcomes					
<b>Mortality</b>	7 (2.7%)		7 (15.2)		<b>0.0008</b>

Variable	Pediatric Hospital (n = 118)		Adult Hospital (n = 185)		p Value
	No. of Patients	Mean ± SD	No. of Patients	Mean ± SD	
Patient factors					
<b>Age at surgery (y)</b>	22 ± 6.6		37 ± 12.9		<0.0001
<b>Coexisting medical problems</b>	21 (18%)		115 (62%)		<0.0001
<b>STS database defined risk factors</b>	5 (4.2%)		63 (34.1%)		<0.0001
Previous operations	81 (69%)		143 (77%)		0.124
Operative factors					
RACH score	2.01 ± 0.9		2.17 ± 0.7		0.978
Outcomes					
<b>Mortality</b>	6 (5.1%)		8 (4.3%)		0.153

	n (%)
Adverse noncardiac events	
Renal insufficiency	8 (6)
Decubitis ulcer (stage 3 or 4)	6 (4)
Pneumothorax	5 (4)
Pleural effusion	4 (3)
Incision site infection	4 (3)
Stroke	3 (2)
Psychosis/depression	3 (2)
Liver dysfunction	3 (2)
Reintubation/tracheostomy	3 (2)
Sepsis	2 (1)
Urinary retention/urinary tract infection	2 (1)
Seizure	1 (1)
Brachial plexus injury	1 (1)
Pneumonia	1 (1)
Epistaxis	1 (1)
Cholelithiasis	1 (1)
Pulmonary embolus	1 (1)
Obstructive sleep apnea	1 (1)
Retained chest tube	1 (1)
Adverse cardiac events	
Ventricular tachycardia	13 (10)
Atrial ectopic tachycardia	12 (9)
Atrial fibrillation/flutter	10 (7)
Supraventricular tachycardia	3 (2)
Surgical intervention for bleeding	3 (2)
Ventricular systolic dysfunction	3 (2)
Junctional tachycardia	2 (1)
Pericardial effusion (moderate)	2 (1)
Cardiac arrest	2 (1)
Femoral vein thrombus	1 (1)
Systemic hypertension	1 (1)
Accelerated ventricular rhythm	1 (1)

### Summary of Postoperative Adverse Noncardiac and Cardiac Events

There were 53 postoperative adverse cardiac events in 44 patients ( Table 4 ). The most common event was arrhythmia. There were 41 arrhythmias in 36 patients. Ventricular tachycardia (VT), which occurred in 13 patients, was the most common postoperative arrhythmia. The arrhythmias were new onset in 21 patients. The most common new-onset arrhythmia was also VT (n = 9). No patient required placement of a pacemaker or implantable cardioverter-defibrillator as a consequence of perioperative arrhythmias.

**Rossano JW et al Ann Thorac Surg 2007; 83 : 606-612**

Perioperative Factor	Univariate Risk OR (95% CI)	Adjusted Risk OR (95% CI)	p Value
Older patient age	1.1 (1.02–1.10)	1.1 (1.02–1.12)	0.004
Preoperative atrial fibrillation/flutter	6.9 (2.5–18.6)	7.5 (2.4–23.5)	< 0.001
Preoperative VT or VF	2.7 (1.1–7.0)	5.0 (1.6–15.4)	0.005
NYHA class III or IV	8.5 (1.7–42.9)	5.6 (0.8–41.7)	0.09
Cyanosis	3.7 (1.2–11.1)	2.8 (0.7–11.2)	0.2
Postoperative serum glucose > 200 mg/dL	2.9 (1.3–6.7)	1.8 (0.7–5.0)	0.2

Factors Associated With a Postoperative Adverse Cardiac Event, Multivariable Analysis

CI = confidence interval; NYHA = New York Heart Association; OR = odds ratio; VF = ventricular fibrillation; VT = ventricular tachycardia

Rossano JW et al Ann Thorac Surg 2007; 83 : 606-612

# Treatment

- \* Transplantation
  - \* Becoming more frequent
  - \* Often in a poor state perioperatively
  - \* Renal Support Common
  - \* RV problems





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# Challenges

- \* Training
- \* Capacity
- \* Adult disease in the ACHD population

