

# Significance of CHD from public health perspective and the economics of managing CHD

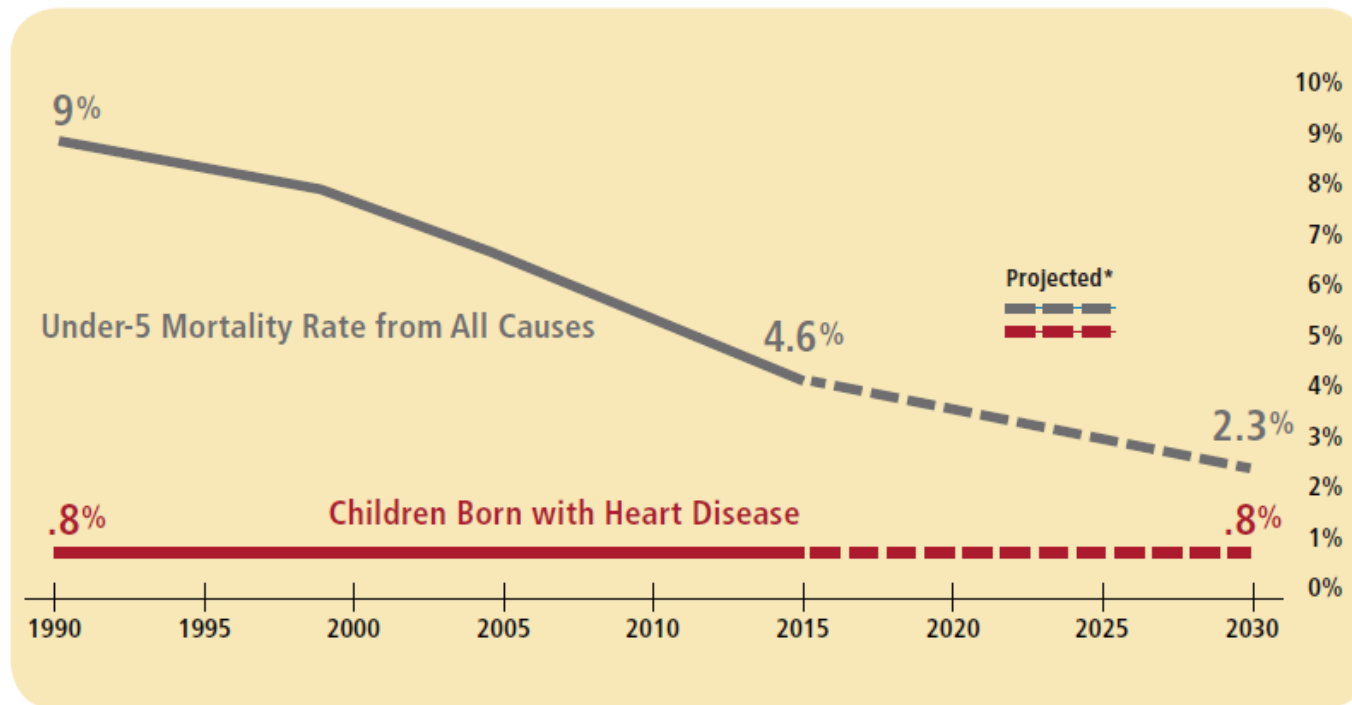
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# Key Questions

1. What proportion of infant mortality result from CHD?
2. What about morbidity and health care costs?
3. What forms of CHD contribute most to infant/under 5 mortality and morbidity?
4. What resources are required for CHD care?
  - a. Resources required for infant and newborn heart surgery
  - b. Economics of managing CHD? Results of AIMS/ICMR study
  - c. Delivering cost effective care
5. How should we prioritize resource allocation for CHD care?

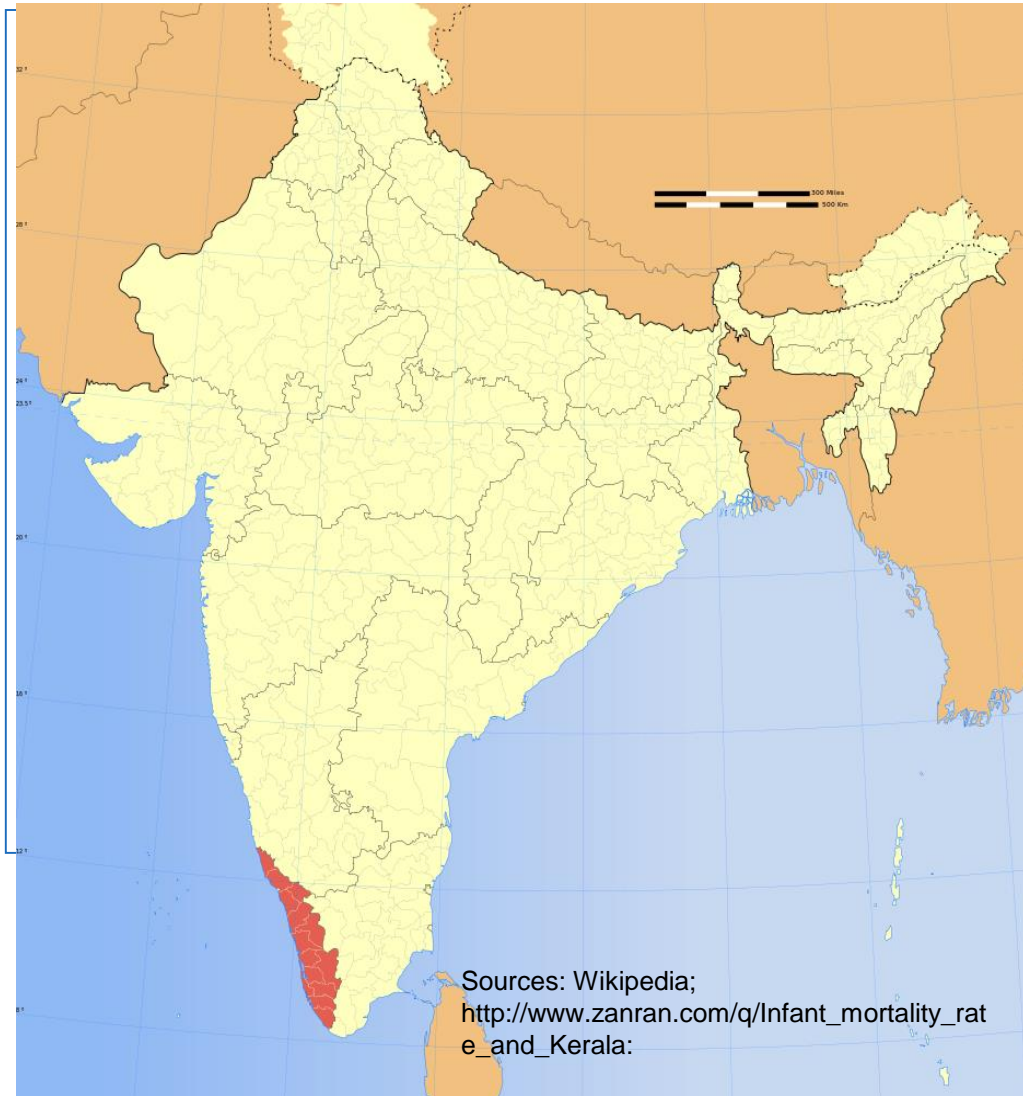
# Significance from Public Health Perspective

## Decreasing U5MR Will Reveal the Constant Burden of Heart Disease



A Case for the Invisible Child, Children's HeartLink, <http://theinvisiblechild.childrensheartlink.org/>

# Kerala Vs. Rest of India



## Kerala

- Congenital Heart disease surfaced as IMR declined
- Need for affordable infant and newborn heart surgery strongly felt in mid 90s

# Estimates for Kerala

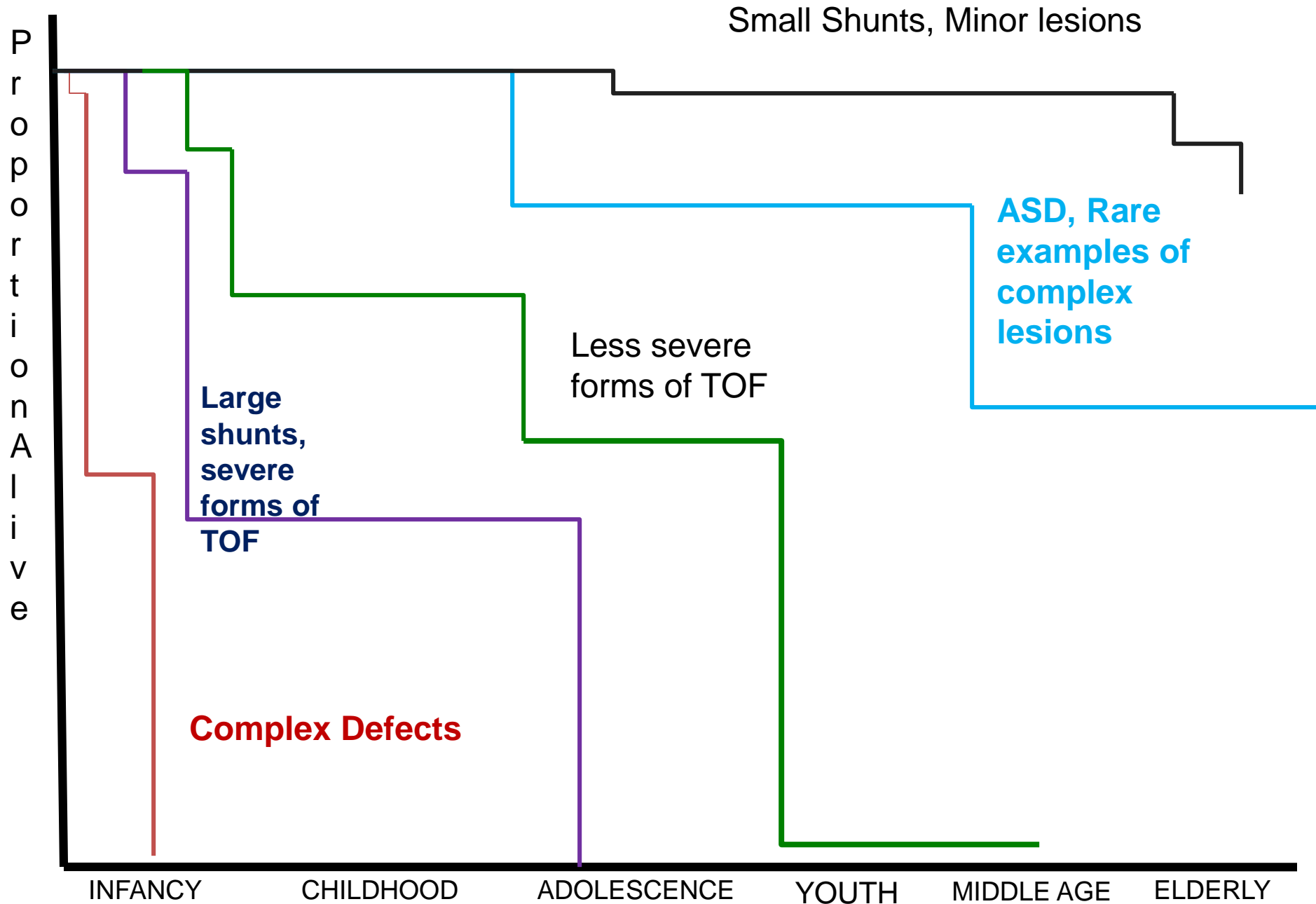
- ~80,000 (0-14 yrs) living with CHD
- ~4000 New CHD per year ,
- 1300: New Critical CHD
- 780 Infant CHD deaths / year

What forms of CHD contribute most to infant/under 5 mortality and morbidity?

# What forms of CHD contribute most to infant/under 5 mortality and morbidity?

Condition	Mortality if uncorrected before 1 year age
Tetralogy of Fallot	25%
Transposition	72%
Persistent Truncus arteriosus	75%
Total anomalous pulmonary venous connection	90%
Duct dependent Pulmonary atresia	~100%
Duct dependent systemic circulation	~100%
Single ventricle variants	75%

\*Adapted from: Mitchell SC, Korones SB, Berendes HW, Congenital Heart Disease in 56,109 Births Incidence and Natural History, Circulation. **1971**;43:323

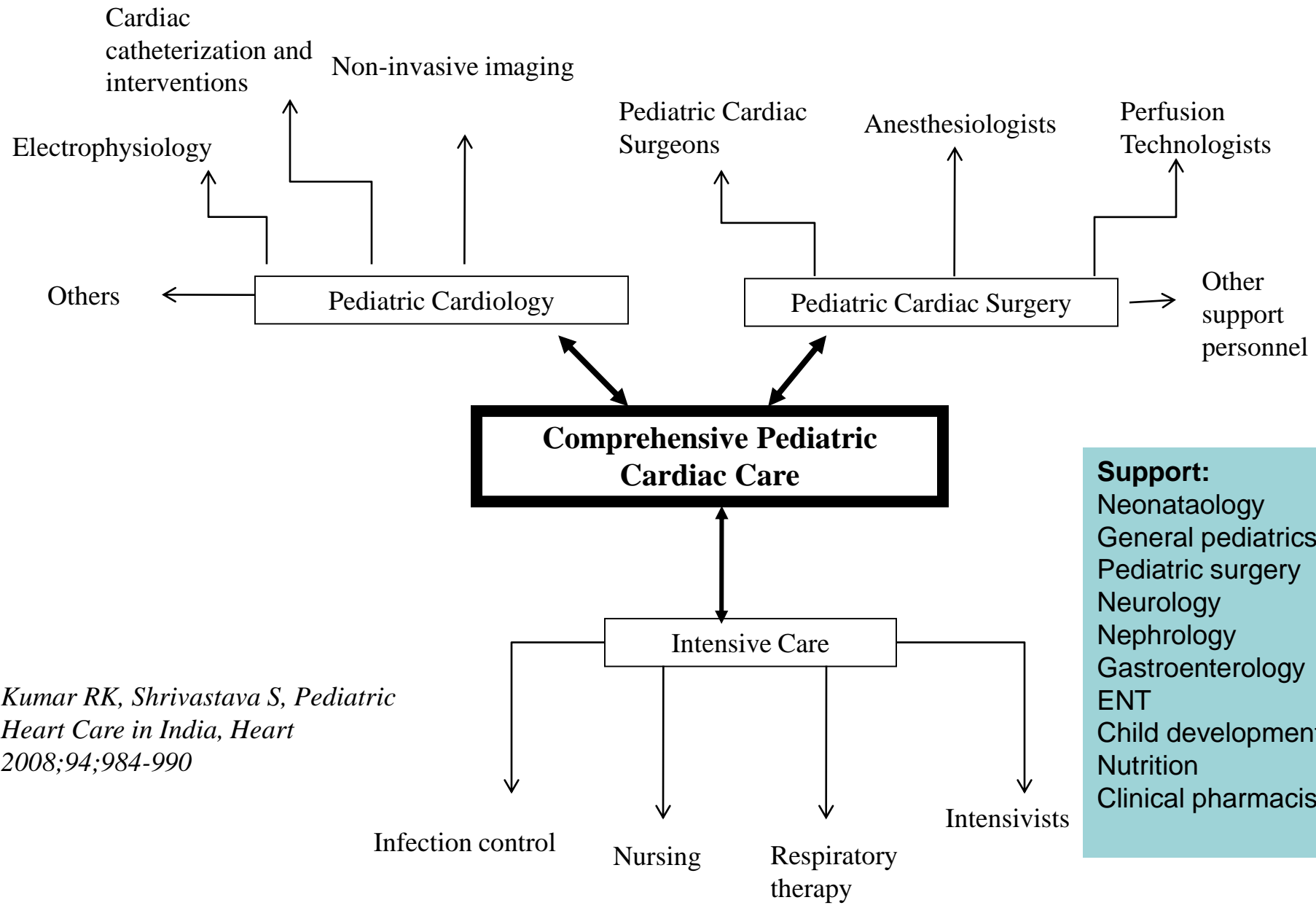




# What saves most lives for children born with CHD?

- A. Infant and newborn heart surgery
- B. Catheter interventions
- C. Medical management

# Resources required for infant and newborn CHD care



**Support:**  
Neonatology  
General pediatrics  
Pediatric surgery  
Neurology  
Nephrology  
Gastroenterology  
ENT  
Child development  
Nutrition  
Clinical pharmacists

*Kumar RK, Shrivastava S, Pediatric Heart Care in India, Heart 2008;94;984-990*

# What is required for developing a pediatric cardiac service?

1. Skilled and committed caregivers
2. Coherent teamwork
3. Robust infrastructure
4. Quality equipment
5. Supportive administration
6. Well-developed and mature referral base
7. Favorable economics and human development in the region
8. A system for charitable care
9. Sustainable systems and services: education and training, nursing
10. Ethical practice environment that is not totally profit driven

Economics of managing CHD?

Results of AIMS/ICMR study

## RESEARCH ARTICLE

# Micro-Economic Impact of Congenital Heart Surgery: Results of a Prospective Study from a Limited-Resource Setting

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# Objectives

## **Primary objective**

- To understand the financial aspects related to cost of congenital heart surgery from the perspective of individual families.

## **Secondary objectives**

- To identify the predictors of higher cost
- To create prediction models for total, direct and indirect hospital costs.

# Methodology

- Baseline and first follow-up data of 644 children admitted for surgery for CHD
- Setting : Tertiary referral hospital, South India
- Data Collection : Prospectively from parents/caretakers
- Study Tool : Questionnaires using a semi-structured interview schedule.
- Main Variables : demographic data, cardiac ailment, surgical details, total & indirect hospital costs

Direct costs included pharmacy, materials, medical/surgical services, diagnostic tests, bed charges & nursing charges. Indirect cost included travel, stay, food expenses and salary loss of bystanders.



# Baseline Data

	n (%)	Median (IQR)
<b>Age (months)</b>		8.2 (3.0 – 36.0)
<b>Hospital stay (days)</b>		13.0 (10.0 – 18.0)
<b>ICU stay (days)*</b>		4.0 (2.0 – 7.0)
<b>Ventilation duration (days)#</b>		1.0 (0.7 – 2.5)
<b>Gender - Male</b>	371 (57.6)	
<b>Place of residence - Rural</b>	491 (76.2)	

\* Details of ICU stay were not available for 24 subjects at baseline

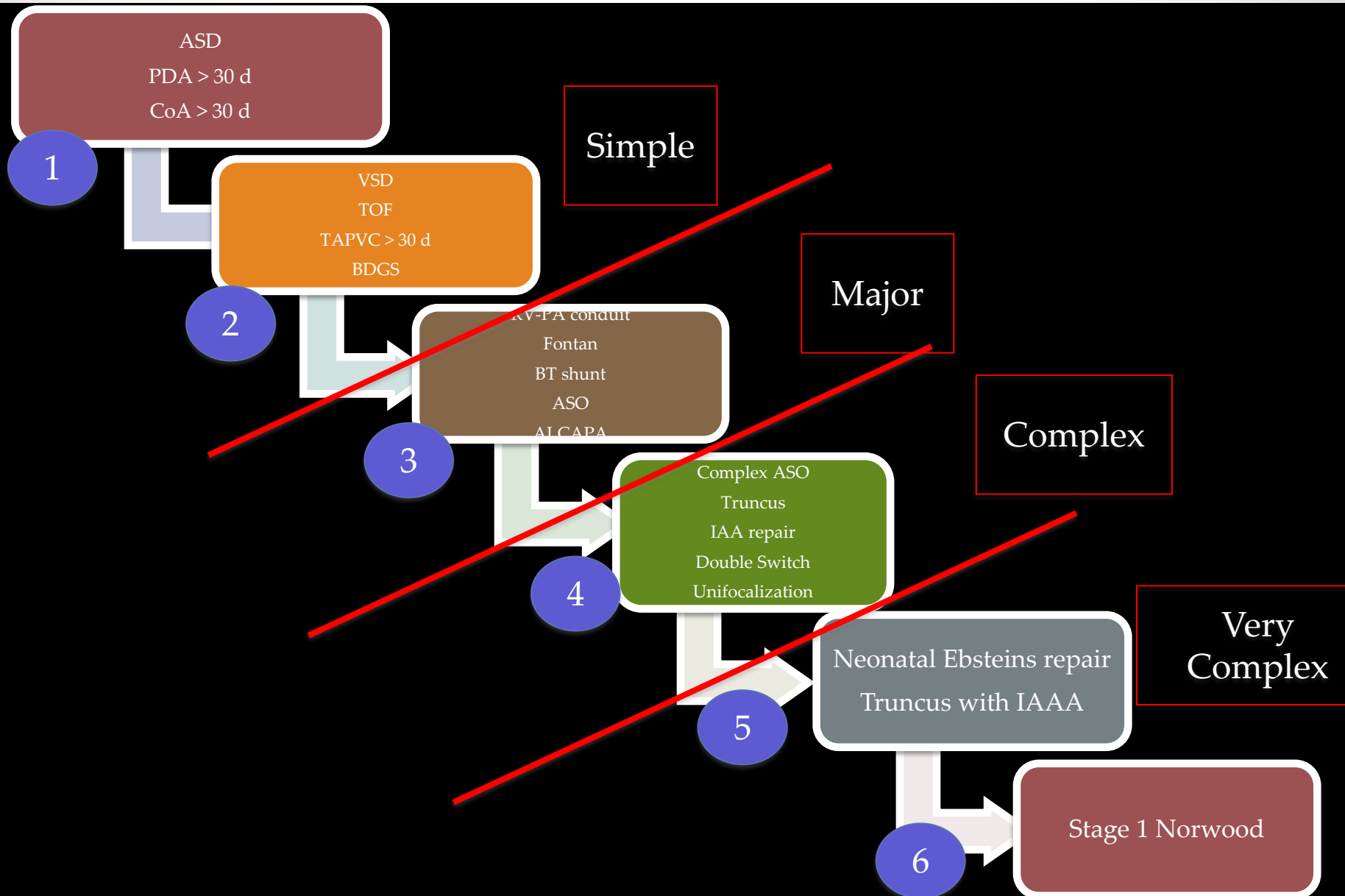
# Details of ventilation time were not available for 21 subjects at baseline

# Surgical Risk Categories

<b>RACHS<sup>\$</sup> Category</b>	<b>n(%)</b>
<b>I (ASD, PDA Coarct)</b>	<b>104 (16·1)</b>
<b>II (VSD, TOF)</b>	<b>306 (47·5)</b>
<b>III (TGA, TAPVC)</b>	<b>163 (25·3)</b>
<b>IV (TGA-VSD, VSD with coarct)</b>	<b>68 (10·6)</b>
<b>V</b>	<b>0</b>
<b>VI (Norwood)</b>	<b>3 (0·5)</b>

\$ Risk adjustment for Congenital Heart surgery

# Severity of CHD: RACHS system



# Total Costs – RACHS & SEC

	Total Hospital Expenses *	
	INR Median (IQR)	IS* * Median (IQR)
<b>RACHS</b>		
1	142863 (123549–170059)	8484 (7337–10099)
2	189707 (166211–234820)	11265 (9870–13944)
3	266020 (211235–313350)	15797 (12544–18607)
4 & 6	269822 (211399–349974)	16023 (12553–20782)
<b>Socio economic class</b>		
Lower	185189 (156139–248303)	10997 (9272–14745)
Middle	203940 (164188–270331)	12111 (9750–16053)
Upper	212974 (165495–352916)	12647 (9828–20957)
<b>All</b>	201898 (163287–266139)	11989 (9696–15804)

\* Without excluding the amount of financial support

\*\*Based on 2010 rates

# Risk factors and Total cost for surgery

	Median ratio [95% CI]; p-value	
	Crude	Adjusted
RACHS category (n = 644) <sup>1</sup>		
I	0.54 [0.49–0.59]; <0.001	0.51 [0.47–0.56]; <0.001
II	0.73 [0.67–0.79]; <0.001	0.73 [0.68–0.79]; <0.001
III	0.95 [0.87–1.03]; 0.221	0.95 [0.87–1.03]; 0.202
IV and above	1.00	1.00
Hospital stay days (n = 644) <sup>2</sup>		
Each additional day	1.03 [1.03–1.03]; <0.001	1.03 [1.02–1.03]; <0.001
ICU stay days (n = 620) <sup>3</sup>		
Each additional day	1.05 [1.04–1.05]; <0.001	1.04 [1.03–1.04]; <0.001
Socio-economic status (n = 644) <sup>4</sup>		
Upper	1.26 [1.07–1.49]; 0.006	1.23 [1.04–1.46]; 0.014
Middle	1.09 [1.01–1.18]; 0.019	1.09 [1.01–1.17]; 0.027
Lower	1.00	1.00

<sup>1</sup>Adjusted for age and annual income;

<sup>2</sup>adjusted for RACHS, age, and annual income;

<sup>3</sup>adjusted for RACHS, age, and income;

<sup>4</sup>adjusted for residential status.

# Sources of Funding

Sources	Number (%)
Borrowing money from friends or relatives	321 (49·8)
Pledging gold	219 (34·0)
Private loans	67 (10·4)
Selling gold	33 (5·1)
Pledging property	19 (3·0)
Other sources	39 (6·1)

# Economic Situation

- Median ratio of hospital expense to annual income : 0.93 (IQR : 0.52-1.49)
- 500 families (77.6%) reported debts because of child's disease.
- 212 (42.4%): debts related to child's disease >75% of their total debts
- 365 (73.0%): specific time limits to repay the debts.

# Productivity losses

- Need to quit jobs: 5.1% of fathers, 2.2% of mothers and 1.2% of other relatives
- Loss of job days: 15 (IQR: 11–24)
- Loss of man days was 35 (IQR: 24–50)
- Loss of salary during the period was INR 8000 (IQR: 4500-15000)



# During Follow up (6 month)

- 12.0% of fathers, 4.7% of mothers and 2.2% of other relatives: new job
- 28.5% of fathers, 4.7% of mothers and 0.9% of other relatives: working additional days.
- Corresponding figures were 33.8%, 6.8% and 2.2% respectively for working longer hours.
- 2.5% of fathers and 3.9% of mothers quit their job

## Follow up 6month ...

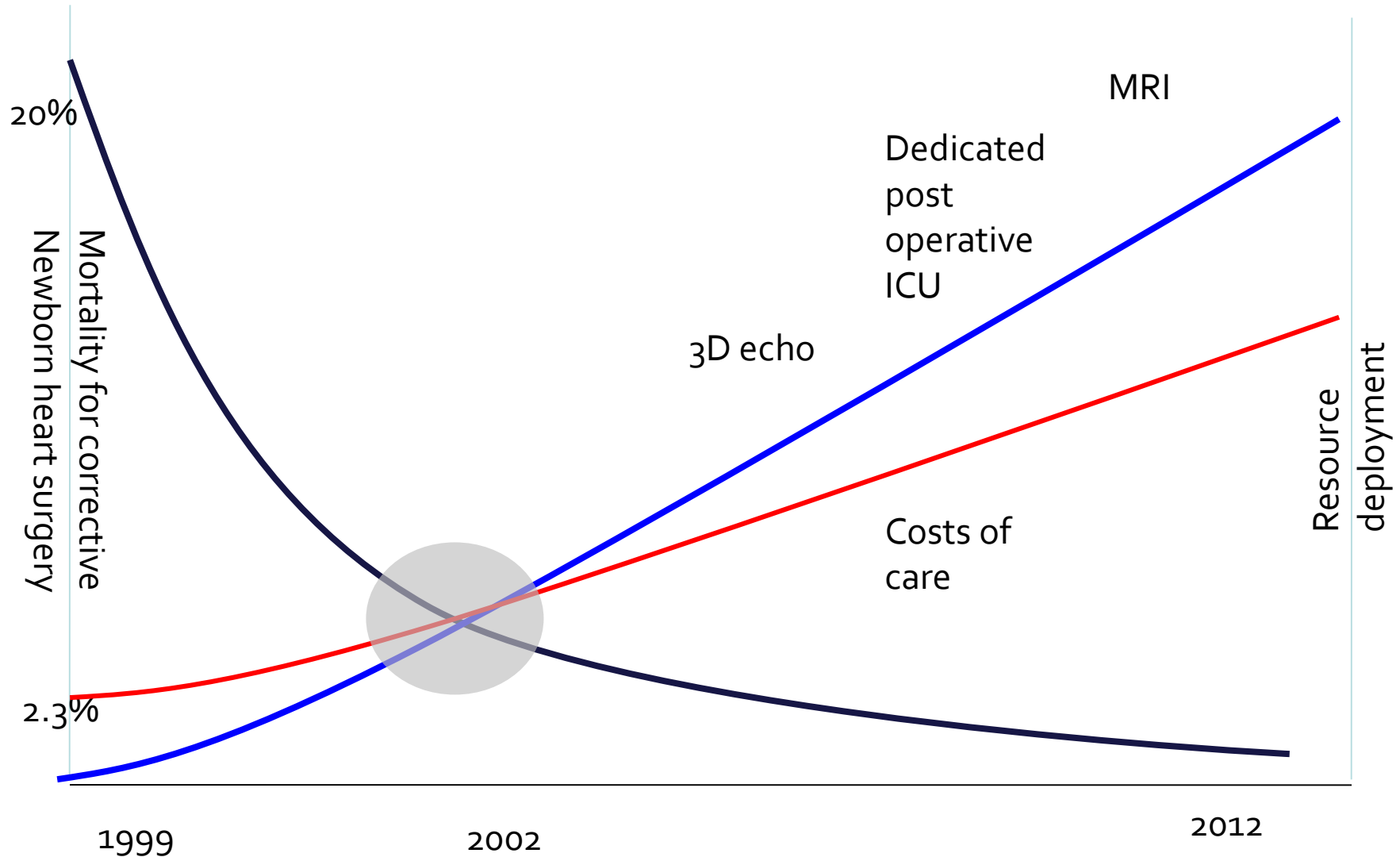
- 290 (52.1%) borrowed money after hospital discharge.
- The reasons reported: meeting treatment expenses or to take care of the child (57.2%) and repayment of earlier loan or debt (28.6%).

# Conclusion

- CHD care is expensive and seriously impacts economic condition of the average family
- Serious efforts to reduce costs of care
- Initiatives to support economically challenged families to minimize the overall financial burden of CHD
  - Government assistance
  - Other sources for charitable support

Delivering cost effective  
pediatric heart care

# Resources Vs. Outcome: Finding the Right Balance



# Pediatric Cardiac Care: Specific Challenges

## Obvious

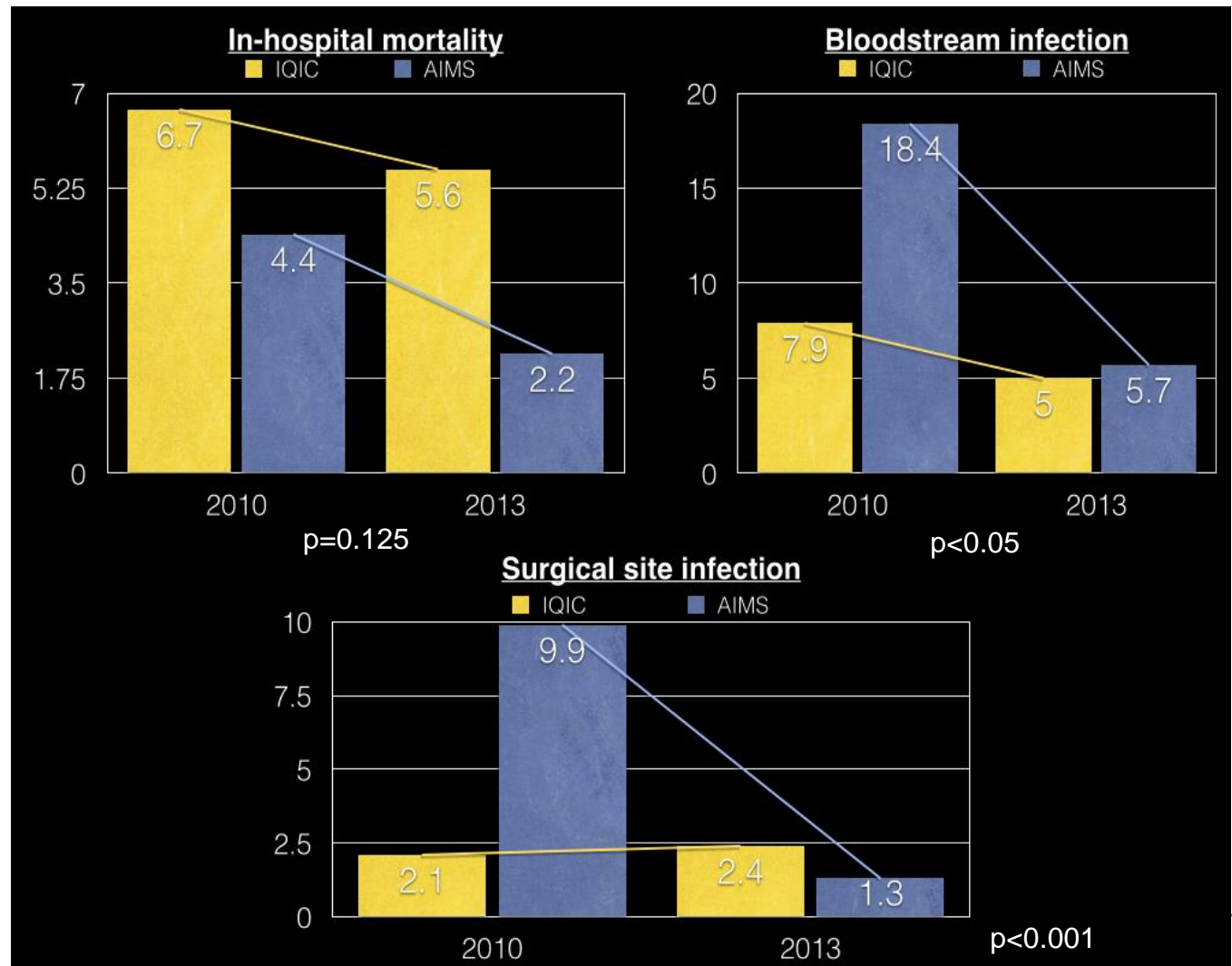
- Resources
  - Human
  - Material
  - Infrastructure
- Patient population
  - Late presentation
  - Co-morbidities
  - Affordability

## Subtle

- Systems:
  - Infection control
  - Clinical audits
  - Surgical checklists
  - Standardized protocols
- Cultural barriers
  - Teamwork
  - Communication
  - Nurse empowerment

# Outcome trends

**Audited data –  
January 2010-  
December 2013:  
2416 heart  
operations;  
43.4% infants,  
12.4% newborns**

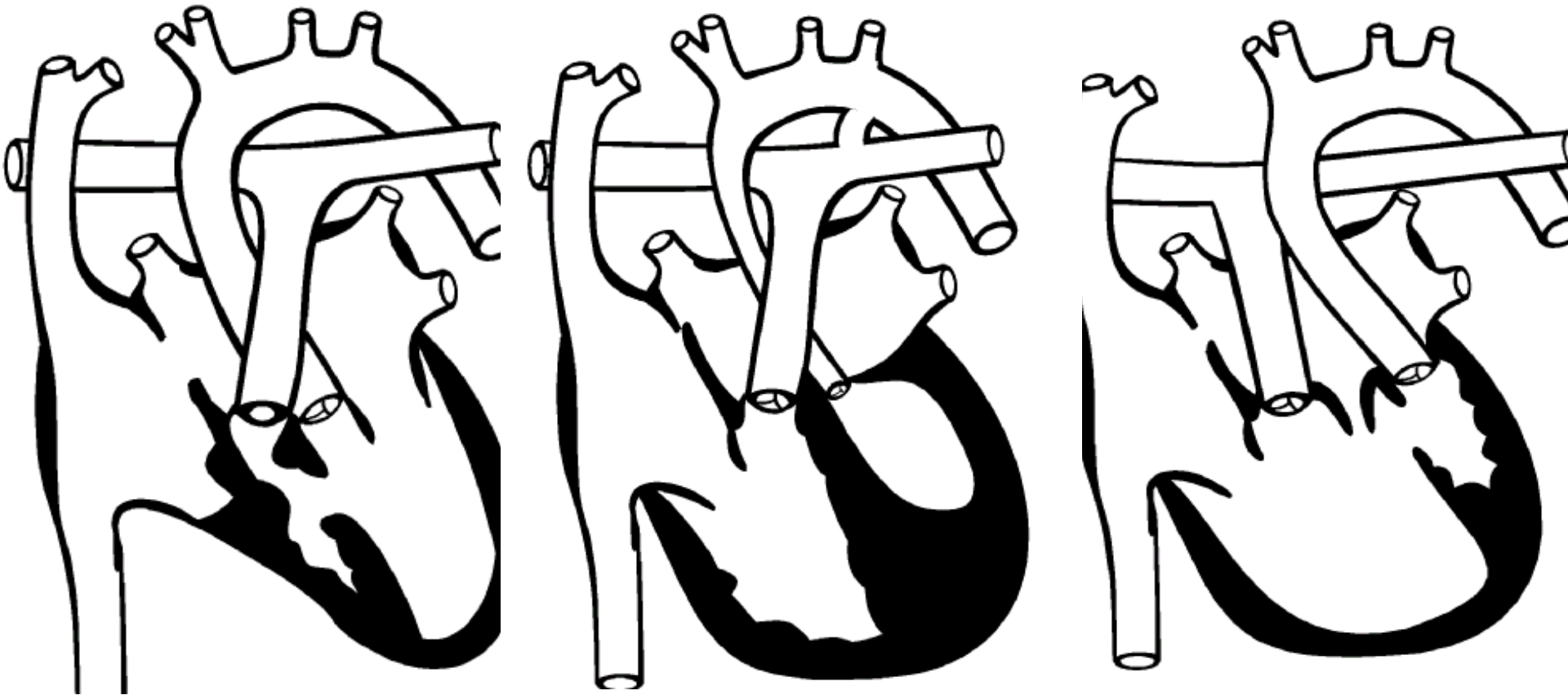


# Prioritizing Care

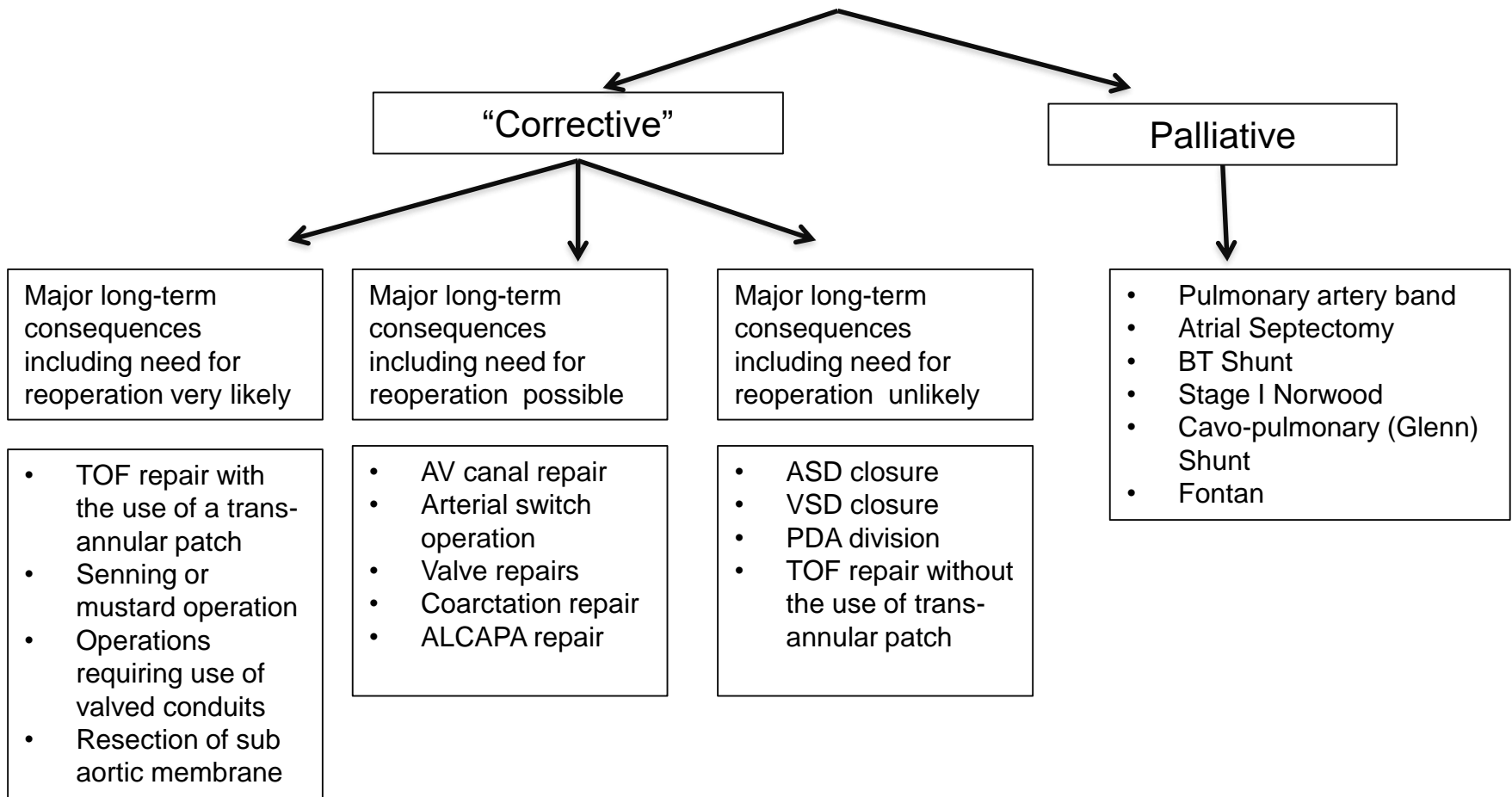
- Severity
- Complexity
- Other defects
- Co-morbidity



## Complex Heart Defects That Cannot Be Corrected



# Congenital Heart Operations



Other important considerations: prematurity, chromosomal and genetic conditions, congenital defects involving other organ systems

# Pediatric Heart Care in Low-Middle Income Countries

*“There is a greater need in investing in manpower training, empowerment, targeted quality improvement interventions, and efficient use of existing resources, rather than in high-cost technology and infrastructure serving niche needs”*

