Pitfalls, heuristics and biases in decision-making & AI support

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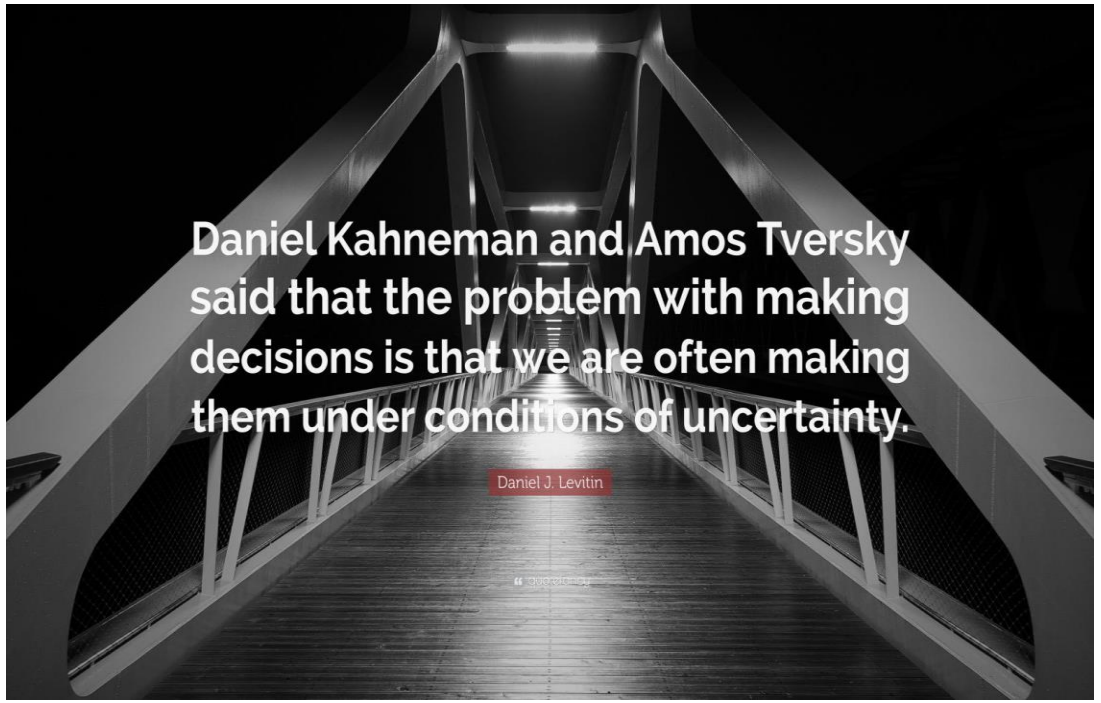
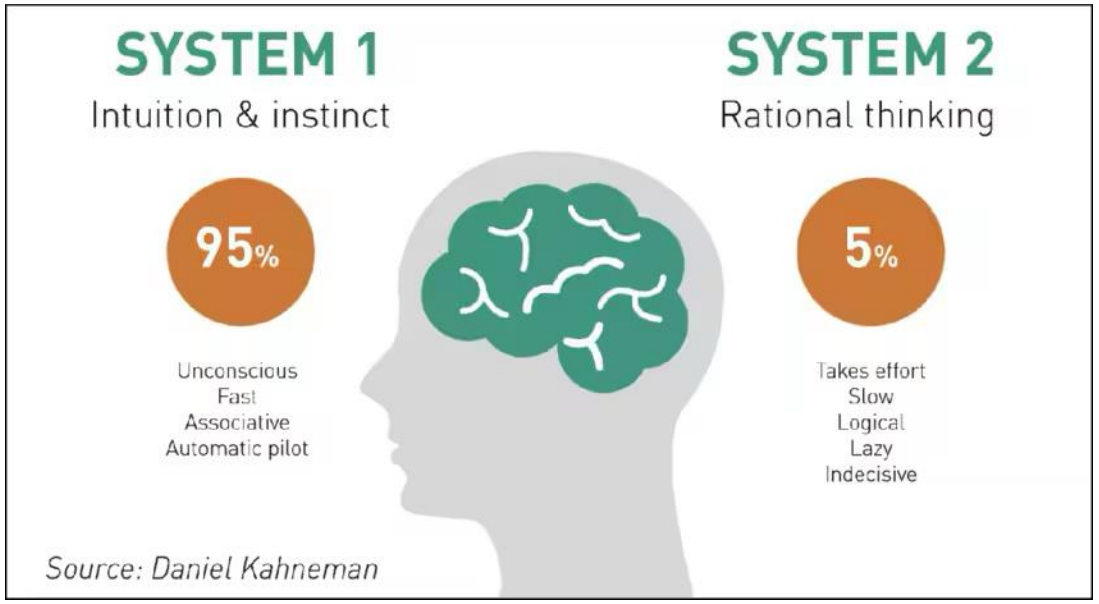
- Nothing to disclose

Decision-Making

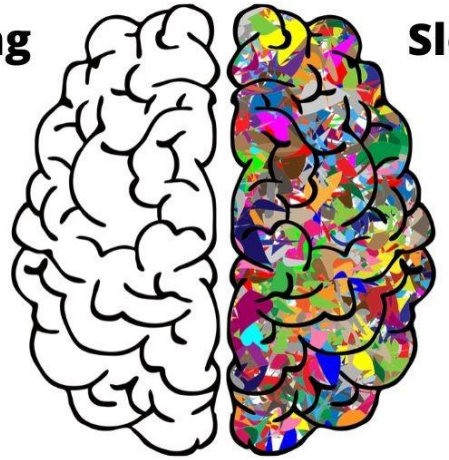


Decision-Making



Fast thinking

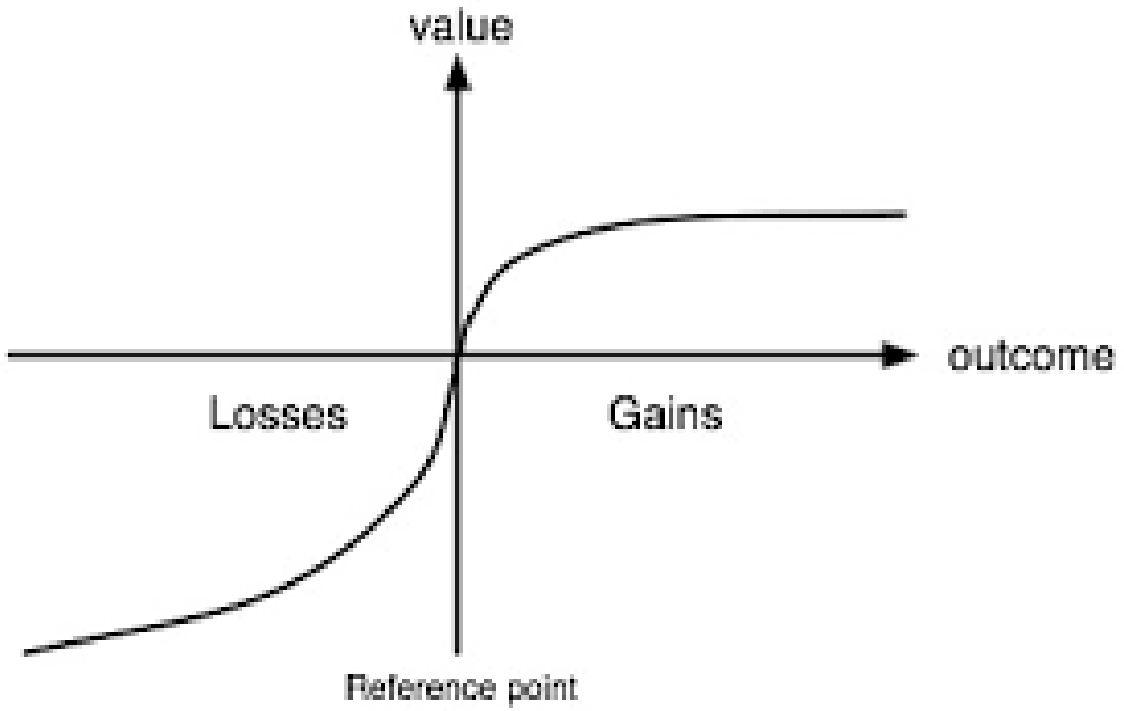
- Fast
- Emotional
- Automatic
- Limited



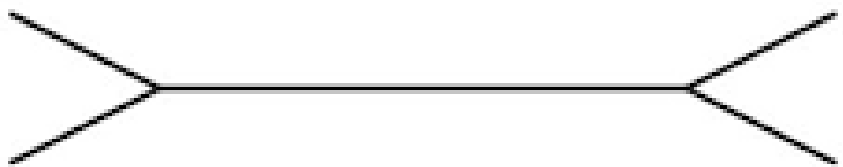
Slow thinking

- Slow
- Controllable
- Smart
- Rational

Decision-Making



Decision-Making



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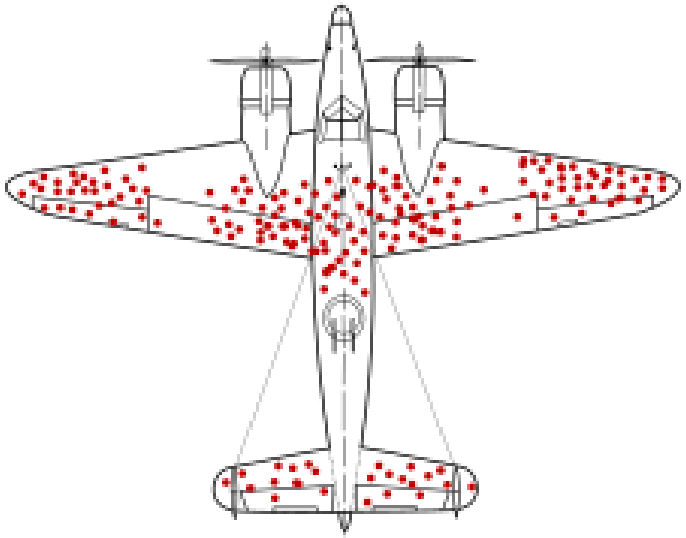
ORIGINAL ARTICLE

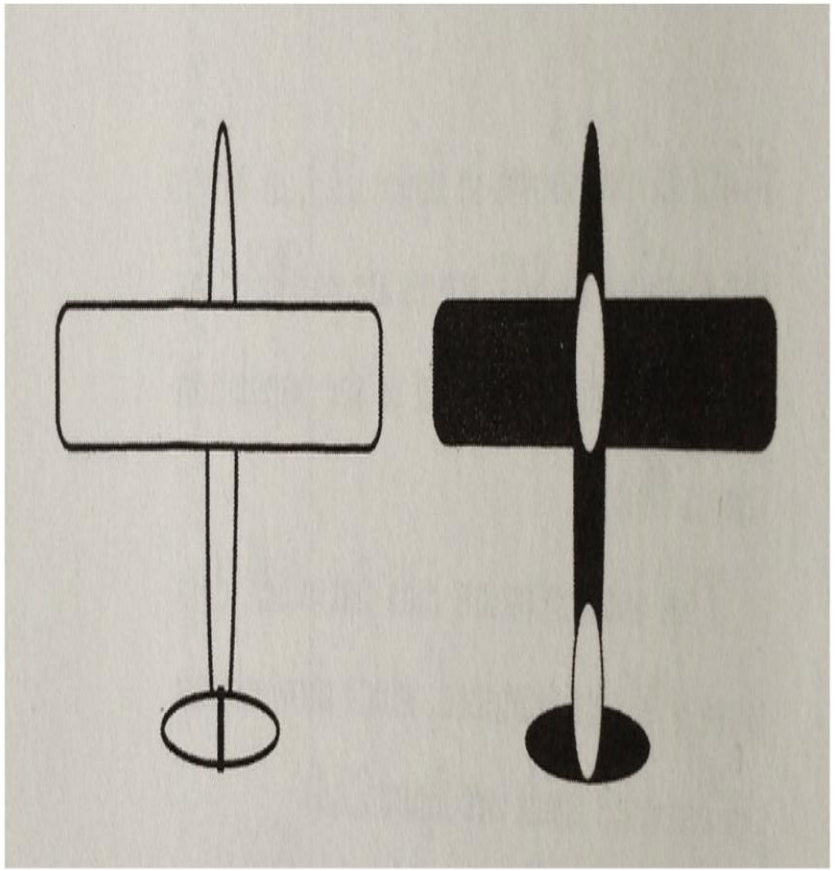
Decision Making in Paediatric Cardiology. Are We Prone to Heuristics, Biases and Traps?

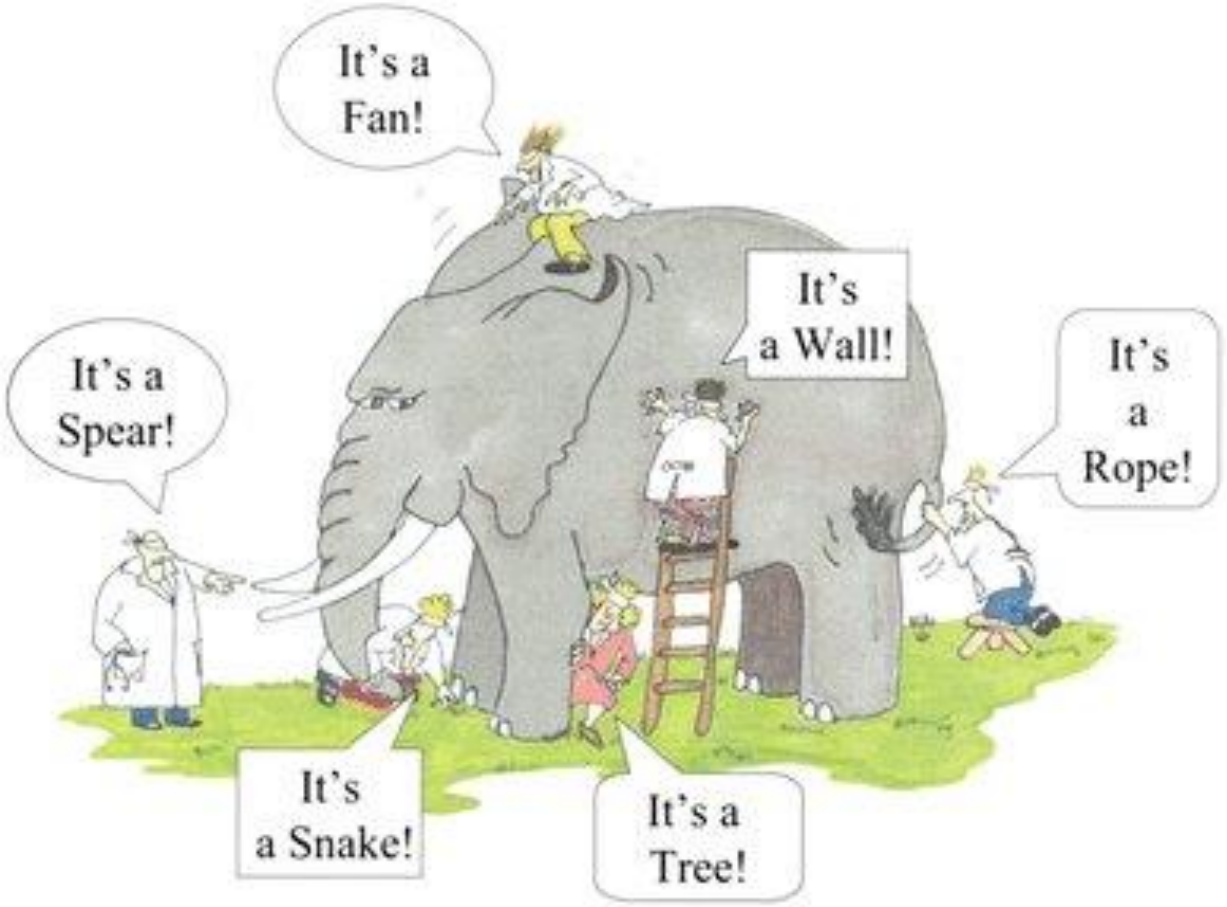
Aedin Ryan[1] · Sophie Duignan[1] · Damien Kenny[1] · Colin J. McMahon[1,2]

Decisions are shaped

- Heuristics
- How do we make decisions?
- Decision-making environment
- Culture *Culture eats strategy for breakfast*
- Asking the right question
- Seeing the unseen data
- Cognitive Bias
- Framing the problem







Blind Men and Elephant Sufi Parable

Decisions - Pitfalls

- Personal Bias (Confirmation Bias)
- Group think
- Status Quo trap
- Sunk costs trap
- Heuristics
  - Availability
  - Representativeness
  - Anchoring

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https://doi.org/10.1007/s00246-018-1899-3

ORIGINAL ARTICLE

Prospective Analysis of Decision Making During Joint Cardiology Cardiothoracic Conference in Treatment of 107 Consecutive Children with Congenital Heart Disease

Sophie Duignan[1] · Aedin Ryan[1] · Dara O'Keeffe[2] · Damien Kenny[1] · Colin J. McMahon[1,3]

Fig. 1 Joint Cardiology Cardiothoracic Surgical Conference or "cath conference" often replicated throughout many paediatric cardiology centres

Duignan Pediatric Cardiol 2018

C1 (Complex 1)—Evidence-based medicine is available, and there is generally consensus among the group but some initial dissent.

C2 (Complex 2)—No evidence-based medicine available but there is consensus among the group.

C3 (Complex 3)—No evidence-based data, there is dissent but consensus finally reached.

C4 (Complex 4)—No evidence-based data available, dissent among the group with no agreement reached necessitating repeat discussion at another JCC because of lack of consensus. Also, cases where an opinion is sought from a different institution because of lack of consensus on the optimum strategy for the child.

Evidence-based medicine supporting our decisions varied between:

1. randomised control trials (RCT)
2. non-randomised studies, case series and reports
3. guidelines. This included international guidelines such as the American Heart Association indications for paediatric catheterisation [12].

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Pediatric Cardiology (2018) 39:1330–1338

Table 1 Complexity grading of cases discussed

	Simple	C1	C2	C3	C4
Observer 1	53	24	17	10	3
Observer 2	49	28	14	13	3
Group	54	25	15	10	3

Observer 1 and 2 paediatric cardiologists. Group represents group consensus on complexity

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C1

An asymptomatic 10-year-old boy (34 kg) with a bicuspid aortic valve, who has had no previous interventions, was discussed due to progressive moderate-to-severe aortic regurgitation and left ventricular dilatation [left ventricular end-diastolic diameter (LVEDD) z score + 2.8]. He maintained normal left ventricular systolic function [left ventricular ejection fraction (LVEF) 72%]. There was agreement among the group that this patient required either an aortic valve repair or a Ross procedure but dissent over the timing; whether to intervene now or to wait a further 6 months for growth. Decision: Eventual consensus to attempt valve repair and, if not possible at time of procedure, to undertake a Ross procedure.

C2

A symptomatic 6.78-kg boy with a moderate perimembranous ventricular septal defect measuring 5 mm × 6 mm and significant left heart volume-overload. This patient was symptomatic despite maximum diuretic therapy. The discussion for this case was initiated and therefore led by an interventional cardiologist among our group. There was a long discussion regarding an alternative to surgical closure with a carotid cutdown to deliver a membranous VSD occluder. A medical cardiologist then discussed concerns regarding heart block with the device. Finally, there was input from surgical team-members advocating for surgical closure. Overall,

C3

A neonate weighing 3 kg with heterotaxy syndrome, an unbalanced atrioventricular septal defect (right ventricle dominant), severe LV hypoplasia, severe central atrioventricular valve regurgitation secondary to severely abnormal atrioventricular valve with deficient septal leaflet, massive atrial dilatation, and double outlet right ventricle with no significant pulmonary stenosis. Optimal management was discussed with uncertainty regarding whether the patient should undergo an atrioventricular valve repair alone or with simultaneous pulmonary artery banding. There was dissent over whether a palliative care route should be followed and whether no intervention was warranted. Decision: atrioventricular valve repair and pulmonary artery banding.

C4

An antenatal diagnosis of left ventricular non-compaction cardiomyopathy with severe hypertrophic cardiomyopathy variant was made at 23-week gestation. Additional echocardiographic findings included moderate left ventricular systolic and diastolic dysfunction, a small-to-moderate ventricular septal defect, mild right ventricular hypoplasia, a large aorto-left-ventricular tunnel with severe aortic regurgitation and a dysplastic bicuspid aortic valve with moderate aortic stenosis. Following a long discussion, this patient was declined for surgical intervention given the severity of the cardiomyopathy and an anticipated inability to tolerate cardiopulmonary bypass. There was a lack of consensus regarding the appropriateness of surgical intervention and so this patient's data were sent for a second opinion to a different institution. Decision: surgical repair of aorto-left ventricular tunnel in referral centre.

Same Data, Different Decision Making

Two patients with discrete juxtaductal coarctation of the aorta were presented at the JCC over a 2-month period. Both patients presented at 13 months of age and had similar presentations. In one child, the consensus was for surgical resection of the coarctation segment via a lateral thoracotomy approach. In the second patient, with the same consultants presenting the case, it was decided to undergo coarctation stenting via a retrograde catheterisation approach. Two patients presenting with identical congenital heart defects, weight and anatomical details (discrete coarctation, bicuspid aortic valve with normal transverse arch size) underwent totally different procedures. There were no medical, social

Duignan Pediatric Cardiol 2018

Mapping Discussion and Anchoring

In situations where the interventional cardiologist presented the data on the child, we did witness a tendency to anchoring effect. A subgroup analysis of nine sequential cases presented by one interventional cardiologist, suitable for either surgery or catheterisation, found the decision for treatment was an interventional cardiology approach in seven cases (78%). Despite the discussion oscillating between cardiac interventionalist, cardiac surgeon and general cardiologist, in a majority of cases the final decision reached was an interventional approach. This may not infer this was the incorrect decision, merely the presence of a possible anchoring effect. This anchoring effect map is outlined Fig. 2.

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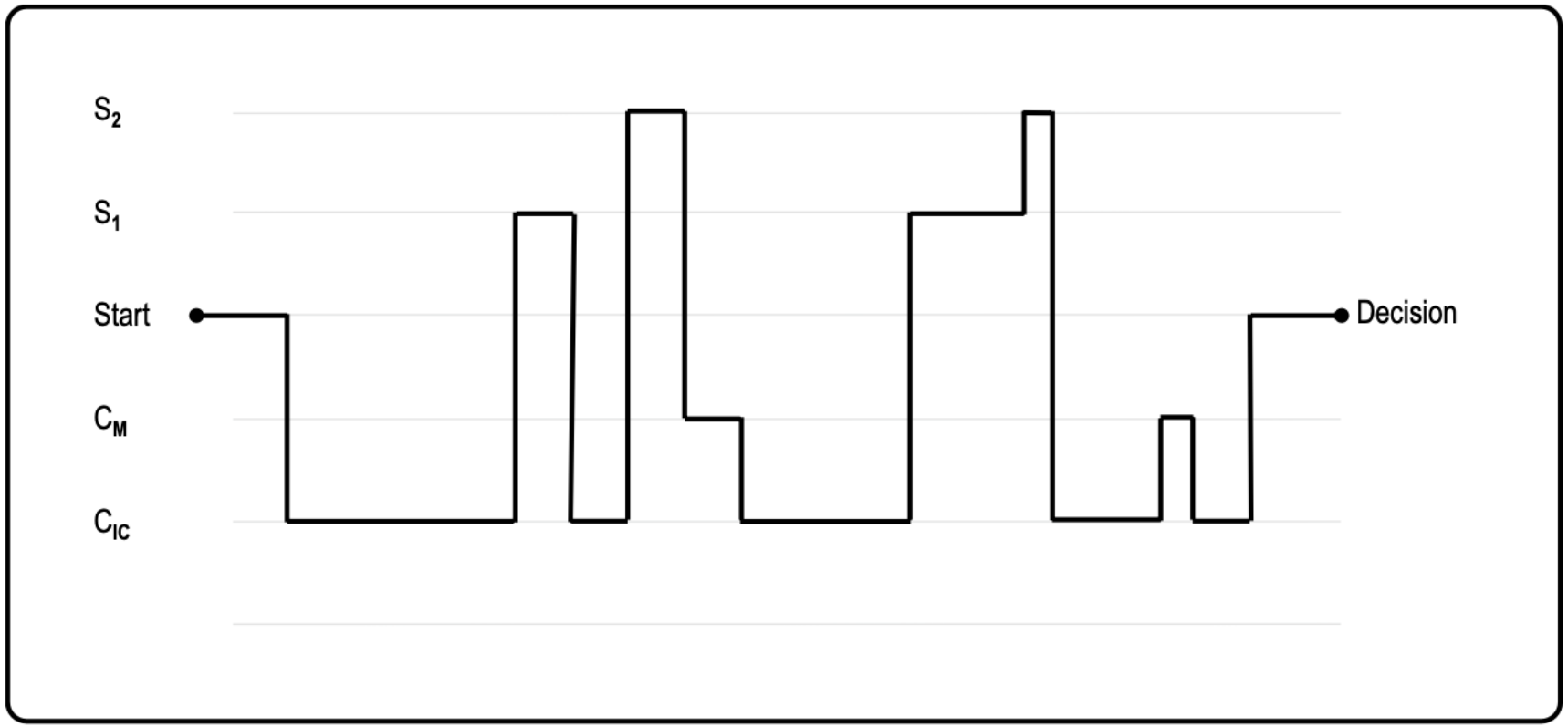
Fig. 2 Mapping of the discussion and decision-making process for a child with perimembranous VSD demonstrating anchoring phenomenon

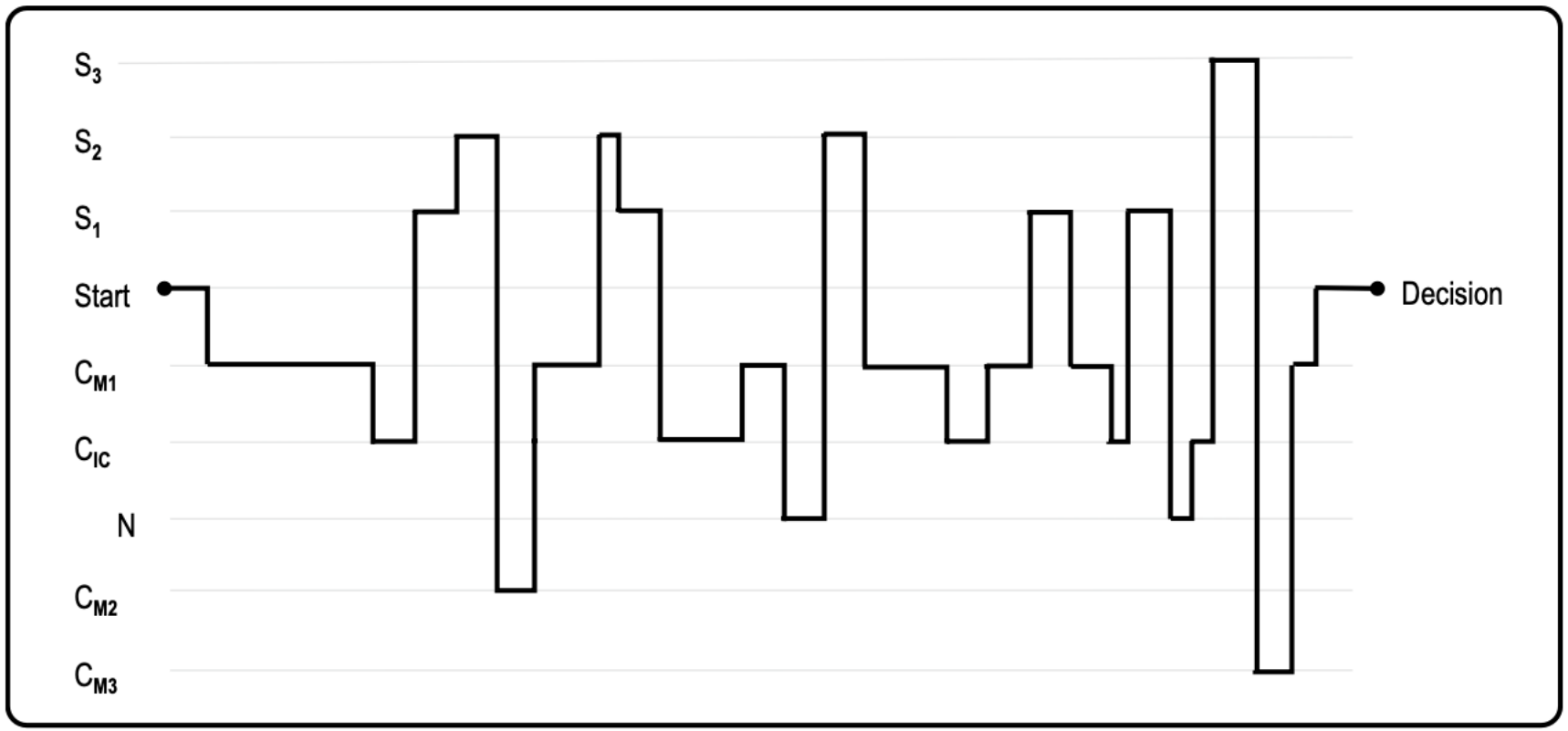


$S_{1,2}$ = Surgical Consultants

C_{IC}= Interventional Cardiologist

C_M = Non Interventional Cardiologist

Fig. 3 Mapping of the discussion and decision-making process for a child with Noonan's syndrome, severe pulmonary regurgitation and RV dilatation after previous pulmonary valvotomy for dysplastic pulmonary stenosis. The interaction of multiple stakeholders with different skillsets may enhance the discussion and reflect an open culture within the department



$S_{1,2,3,}$ = Surgical Consultants

C_{IC}= Interventional Cardiologist

$C_{M1,2,3,}$ = Cardiology Non Interventional Consultants

N = Clinical Nurse Specialist

Considerations

- Which patients require discussion?
- How should patients be presented?
- Who should chair the MDT JCC meeting?
- Avoid pre-MDT anchoring decisions?
- The Vortex of Worry
- Algorithms
- Decision-trees (Hiddink)

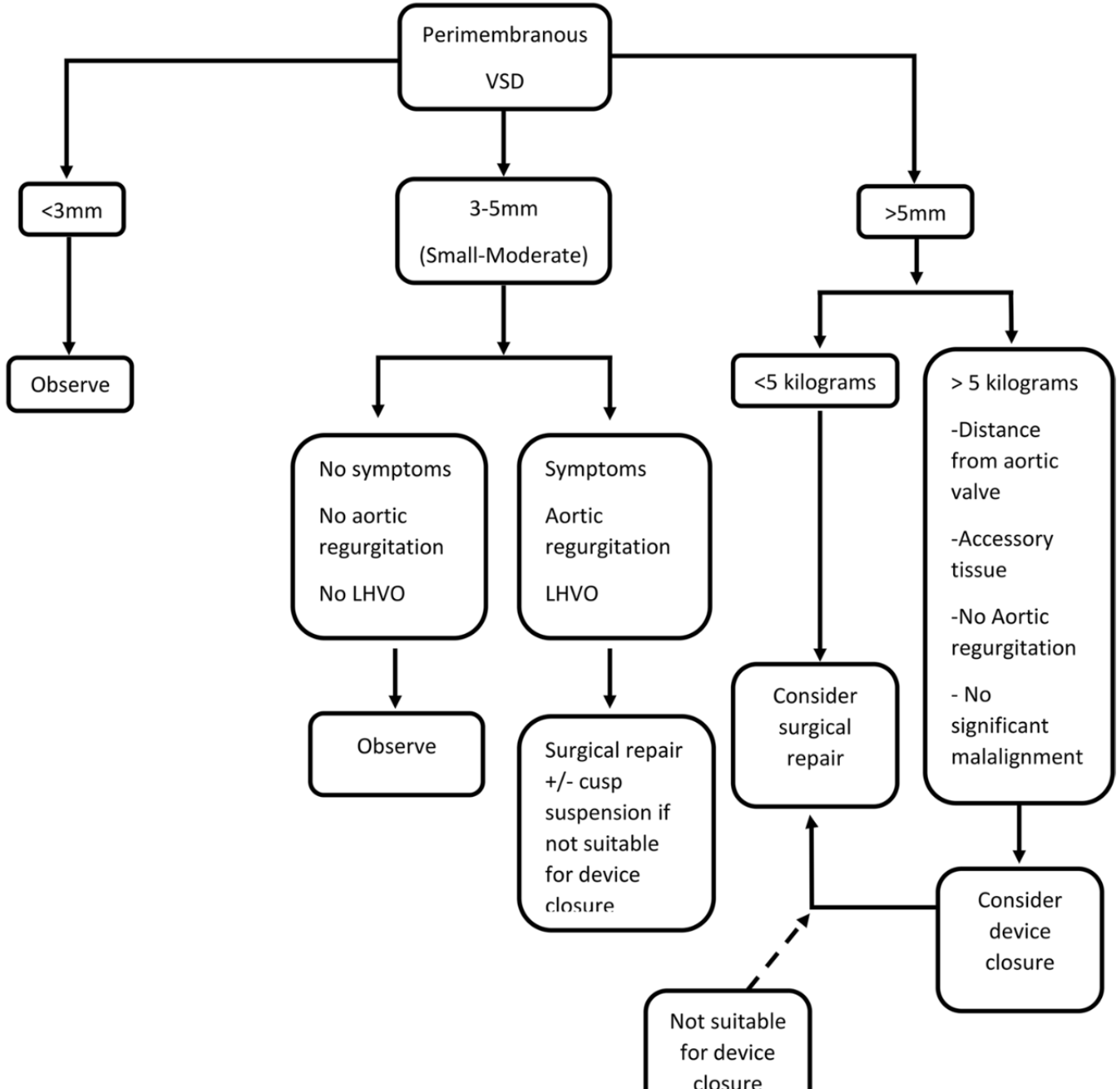


Fig. 4 Generic decision tree for initial decision node (reproduced with permission from Hunink [18]). Symptomatic children less than 5 kg would typically undergo surgical closure of the VSD. In selected cases children > 5 kg where the defect is suitable may be considered for trans-carotid VSD device closure

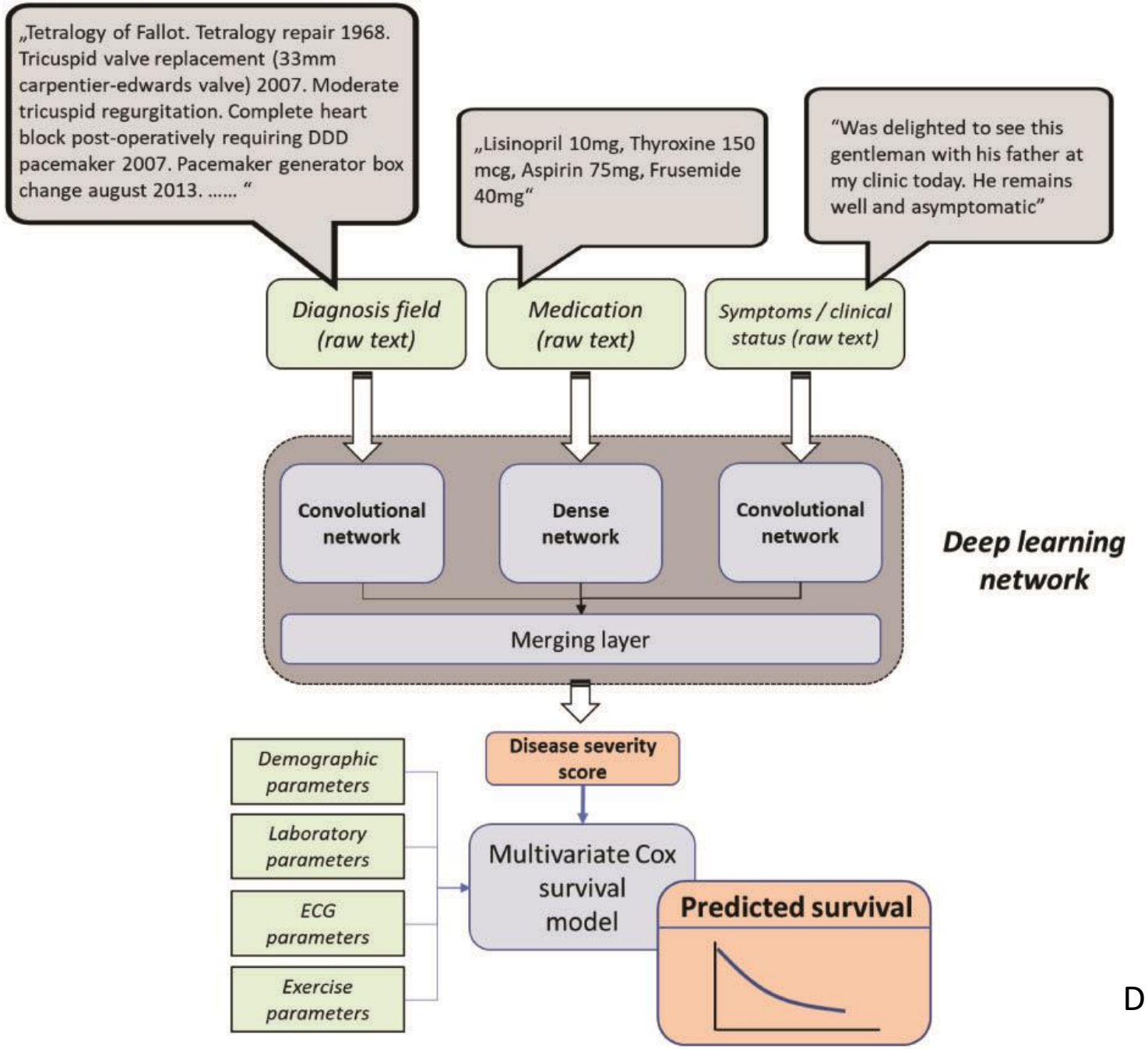
ESC European Society of Cardiology

European Heart Journal (2019) **40**, 1069–1077
doi:10.1093/eurheartj/ehy915

CLINICAL RESEARCH
Congenital heart disease

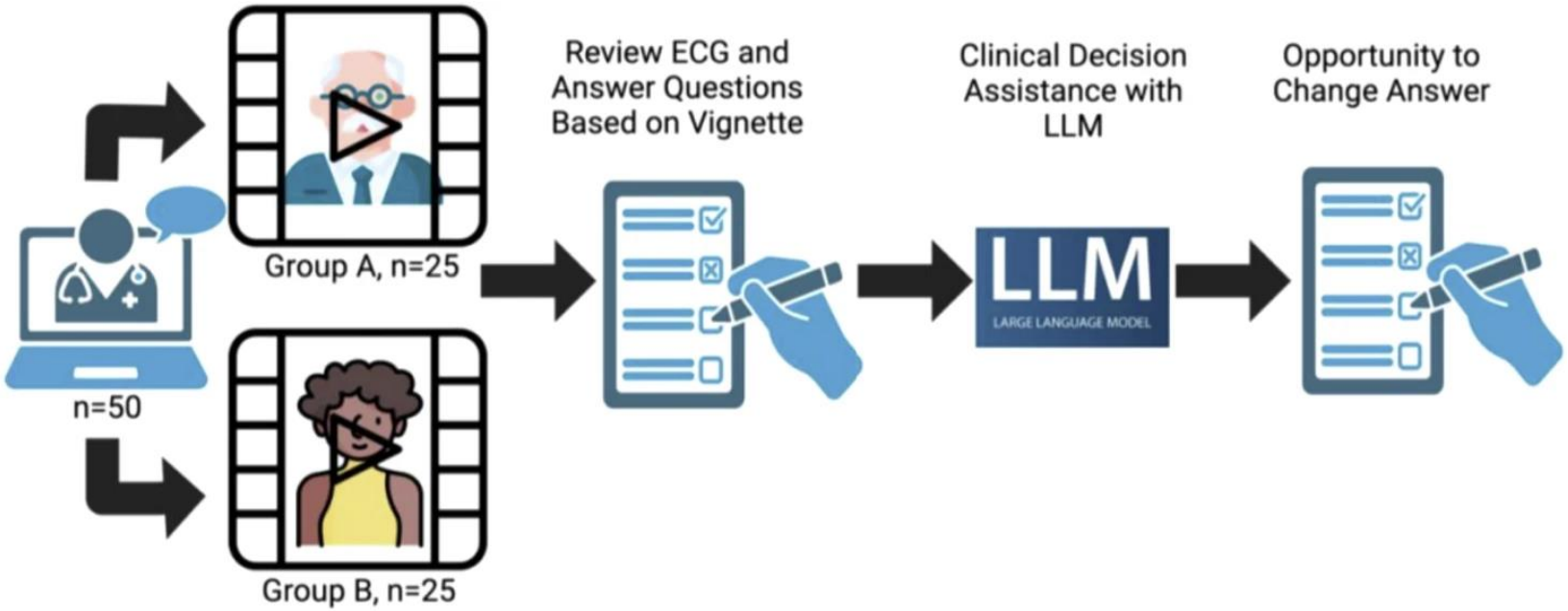
Machine learning algorithms estimating prognosis and guiding therapy in adult congenital heart disease: data from a single tertiary centre including 10 019 patients

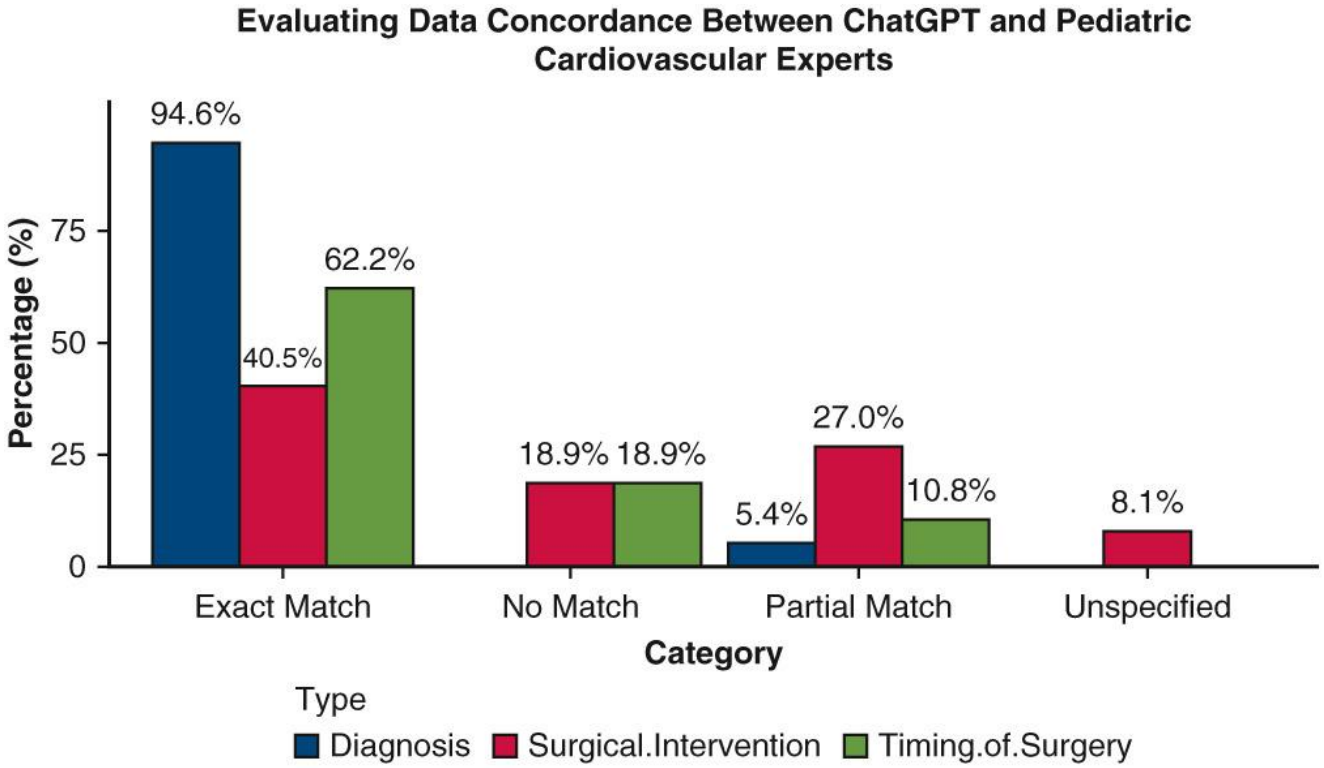
Gerhard-Paul Diller[1,2,3,4]*, Aleksander Kempny[1,2], Sonya V. Babu-Narayan[1,2], Marthe Henrichs[3], Margarita Brida[1,5], Anselm Uebing[1,6], Astrid E. Lammers[6], Helmut Baumgartner[3,4], Wei Li[1,2], Stephen J. Wort[1,2], Konstantinos Dimopoulos[1,2], and Michael A. Gatzoulis[1,2]



Dhiller ESC 2019

AI Decision-Making Assist





ChatGPT demonstrates strong potential as an augmentative tool in pediatric cardiovascular surgery, with accurate diagnosis rates; however, its performance in complex cases underscores the need for further refinement before broader clinical adoption.

Navigating the future of pediatric cardiovascular surgery: Insights and innovation powered by Chat Generative Pre-Trained Transformer (ChatGPT)

Decision-Assist

Fig. 1 Joint Cardiology Cardiothoracic Surgical Conference or "cath conference" often replicated throughout many paediatric cardiology centres

Cardiology in the Young

cambridge.org/cty

Original Article

Cite this article: McMahon CJ, Sendžikaitė S, Jegatheeswaran A, Cheung Y-F, Majdalany DS, Hjortdal V, Redington AN, Jacobs JP

Managing uncertainty in decision-making of common congenital cardiac defects

Colin J. McMahon[1,2,3], Skaistė Sendžikaitė[4], Anusha Jegatheeswaran[5], Yiu-Fai Cheung[6], David S. Majdalany[7], Vibeke Hjortdal[8], Andrew N. Redington[9], Jeffrey P. Jacobs[10], Maryam Asoodar[3], Matthew Sibbald[11], Tal Geva[12], Jeroen J.G. van Merrienboer[3,13] and Justin T. Tretter[14]

MDT Decision-Making Solutions

- No-interruption policy all data is reviewed
- Leaders refraining from immediate input
- Formulate independent judgments prior to sharing recommendations
- Explicit probability estimations grounded in base rates
- External opinions
- Promoting environment that encourages dissenting perspectives

Daily PED CARD 2024

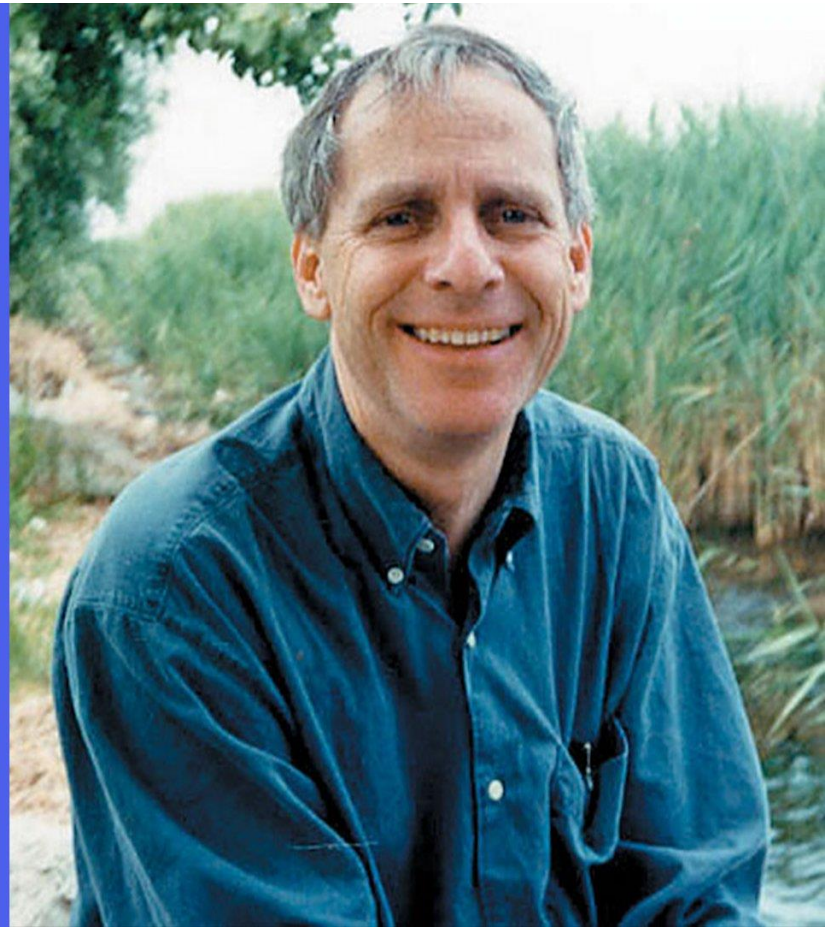
Conclusions Decision-Making in CHD

- Decision-making is challenging in CHD
- Heuristics, Biases prove complex pitfalls
- MDT Meeting specific behaviours mitigate against bias
- Decision trees, SCAMPS, AI may mitigate against bias
- ? AI may prove to be a useful DM assist but needs careful introduction
- Validate use of AI in assisted DM prior clinical introduction

The Economist | On this day

"My colleagues, they study artificial intelligence; me, I study natural stupidity."

Amos Tversky Psychologist




Go raibh maith agat
Thank you