OUTCOMES OF PEDIATRIC PATIENTS SUPPORTED WITH CONTINUOUS FLOW VENTRICULAR ASSIST DEVICES

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DISCLOSURES

- No relevant financial disclosures

- Discuss off label use of ventricular assist devices (VADs) in children

OUTLINE

- Historical perspective
- Outcomes of children supported with continuous flow VADs
- Present challenges / future opportunities

A BRIEF HISTORY OF TIME…. OF VADS

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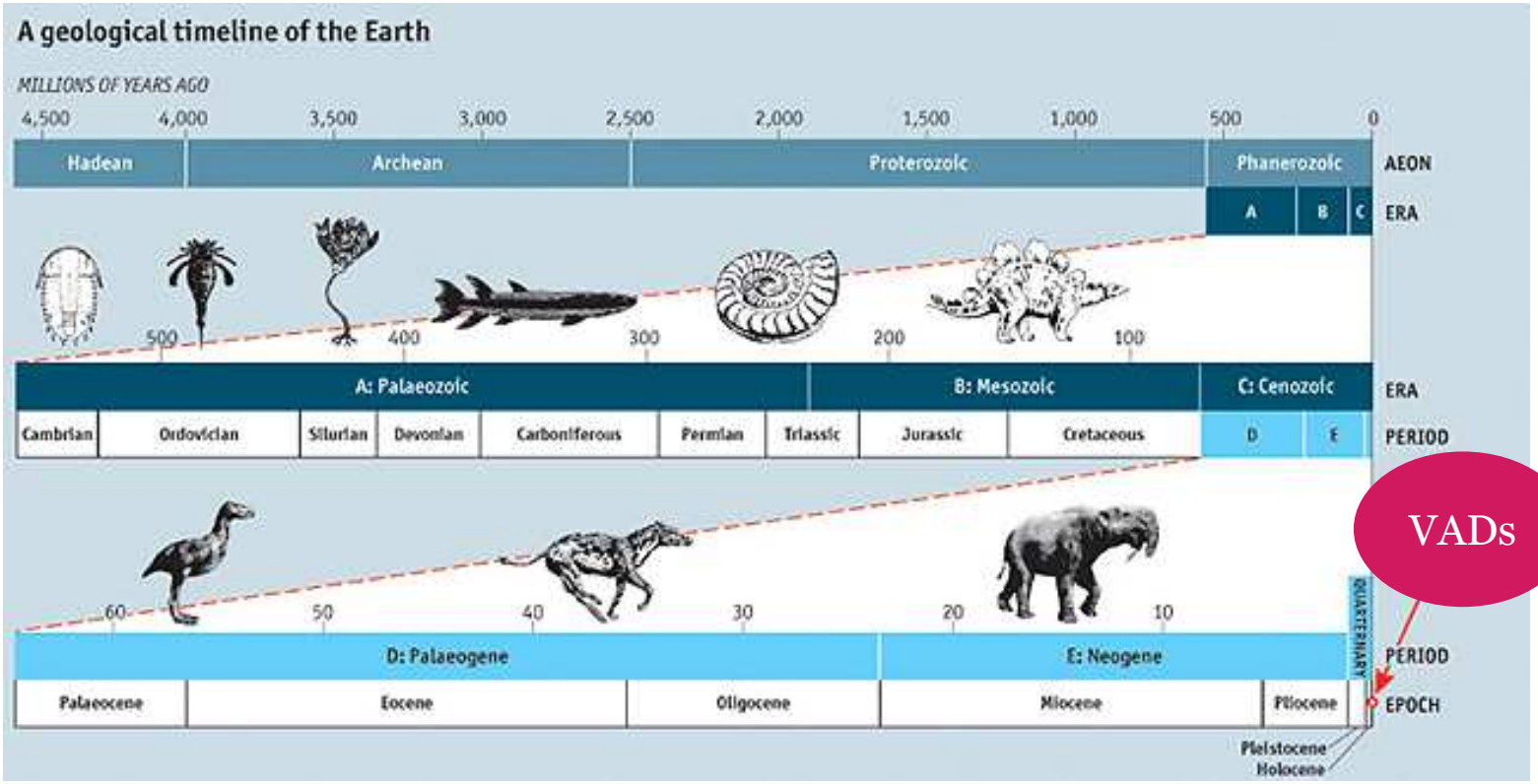
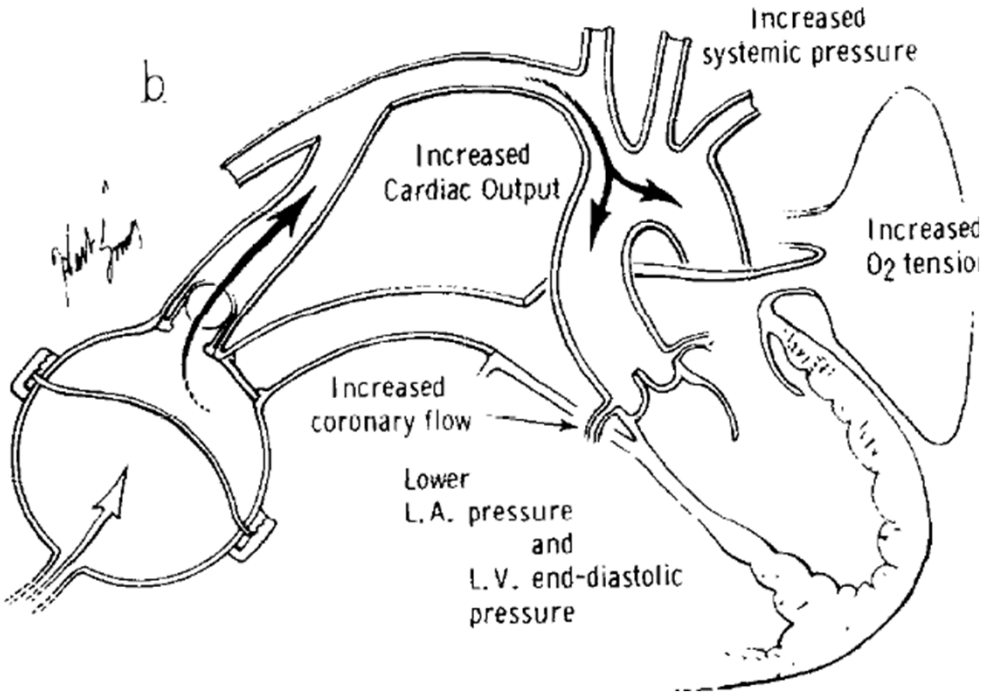


A BRIEF HISTORY OF TIME…. OF VADS

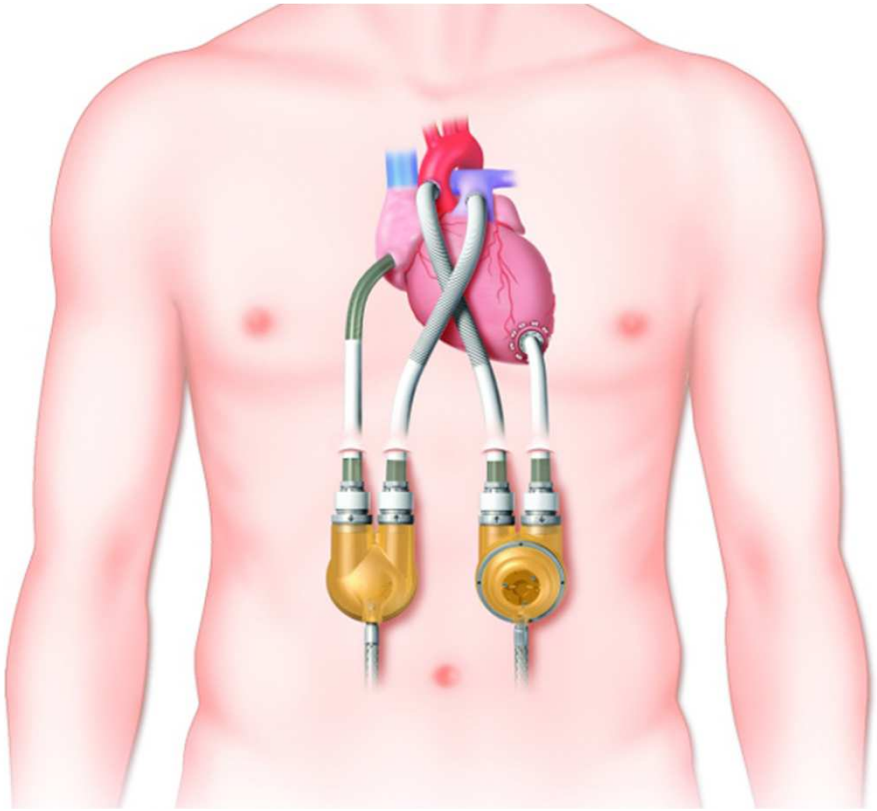
- Gibbons developed first ‘heart lung machine’ ushering in the era of open-heart surgery
  - 1953
- NHLBI funded the ‘Artificial Heart Program’
  - 1964
- DeBakey and Cooley implanted the first LVAD and total artificial heart (TAH)
  - 1966 & 1969

EARLY EXPERIENCE

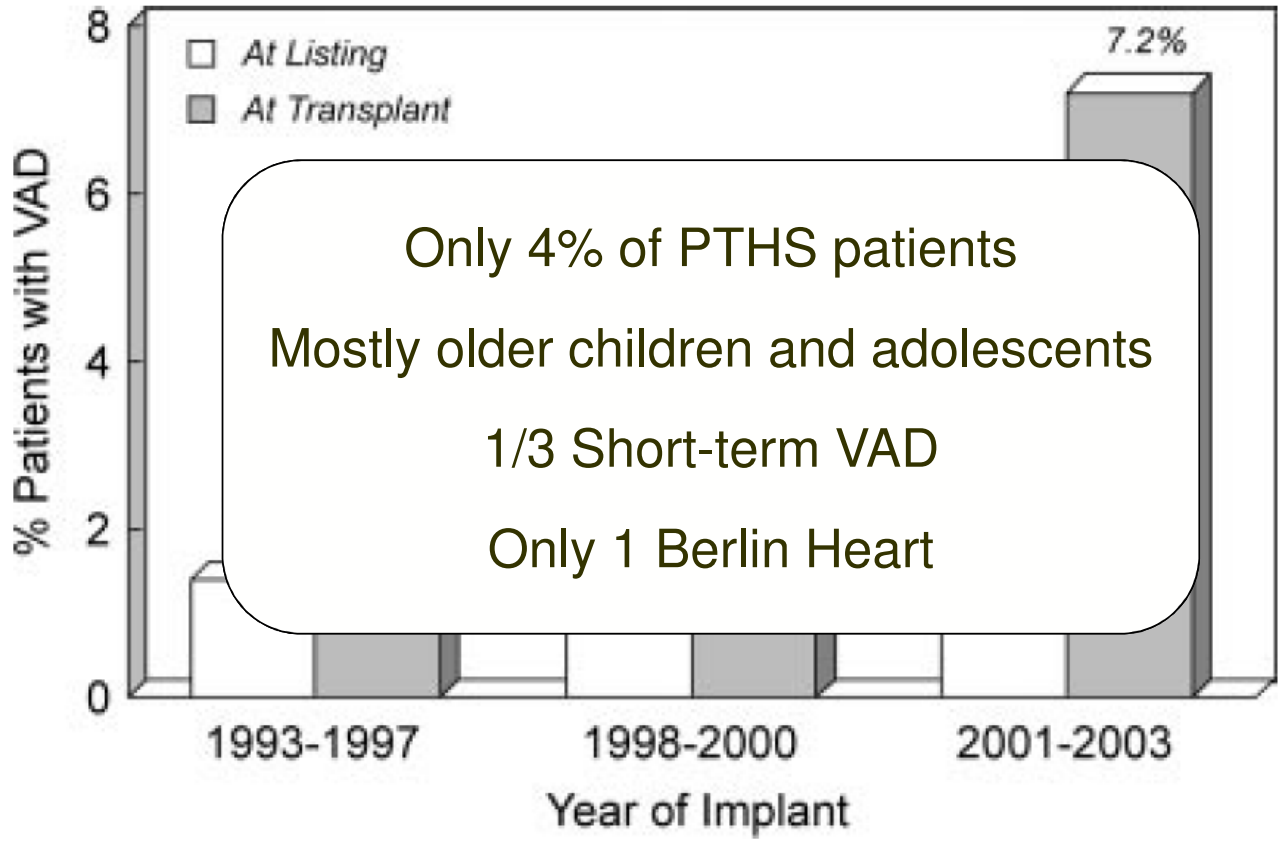


DeBakey ME. Am J Card. 1971

PNEUMATIC PULSATILE PUMPS



HISTORICAL PERSPECTIVE



Only 4% of PTHS patients

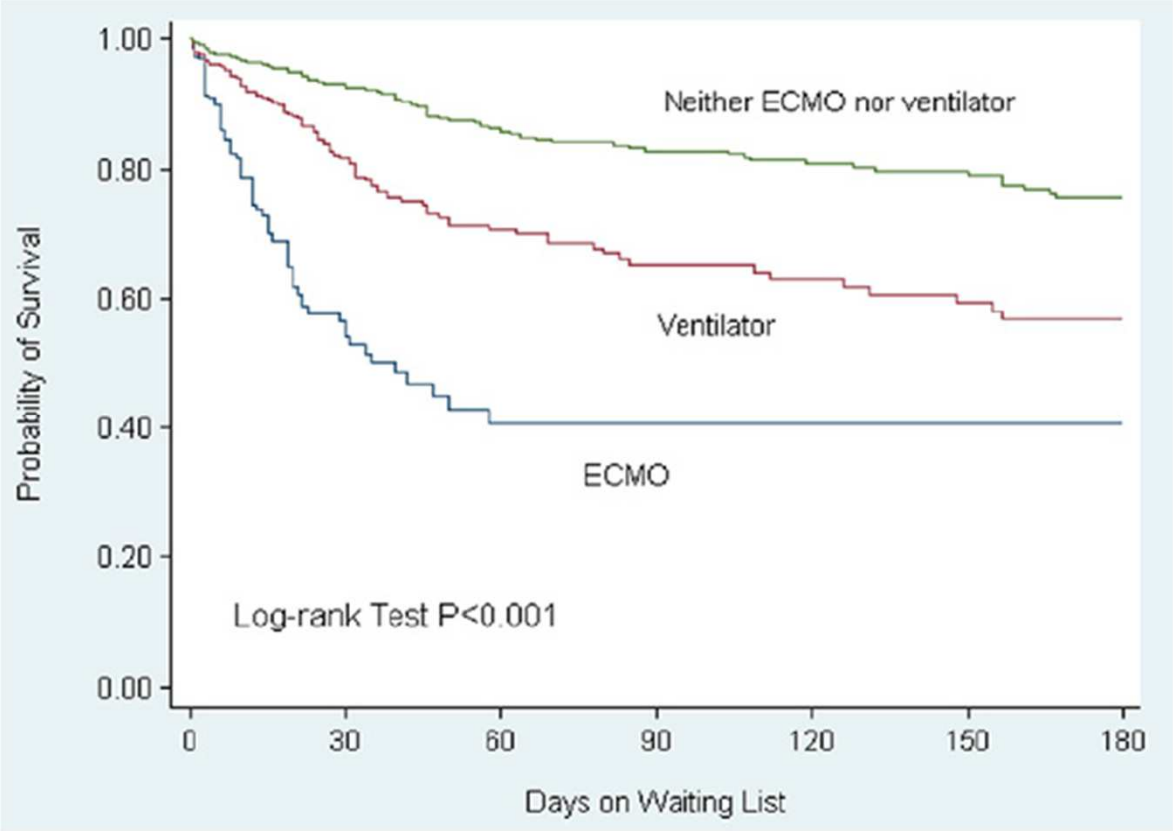
Mostly older children and adolescents

1/3 Short-term VAD

Only 1 Berlin Heart

Blume ED, et al. Circulation 2006

WAITLIST MORTALITY IN INFANTS



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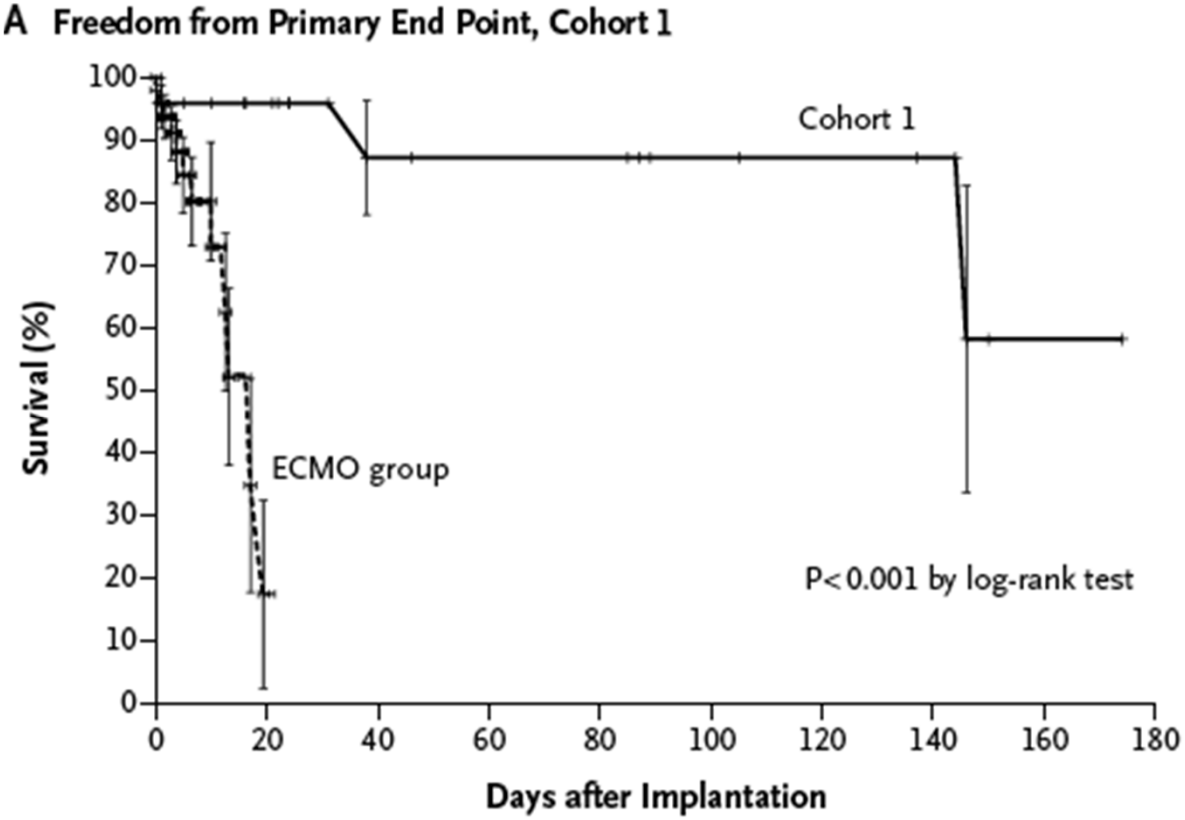
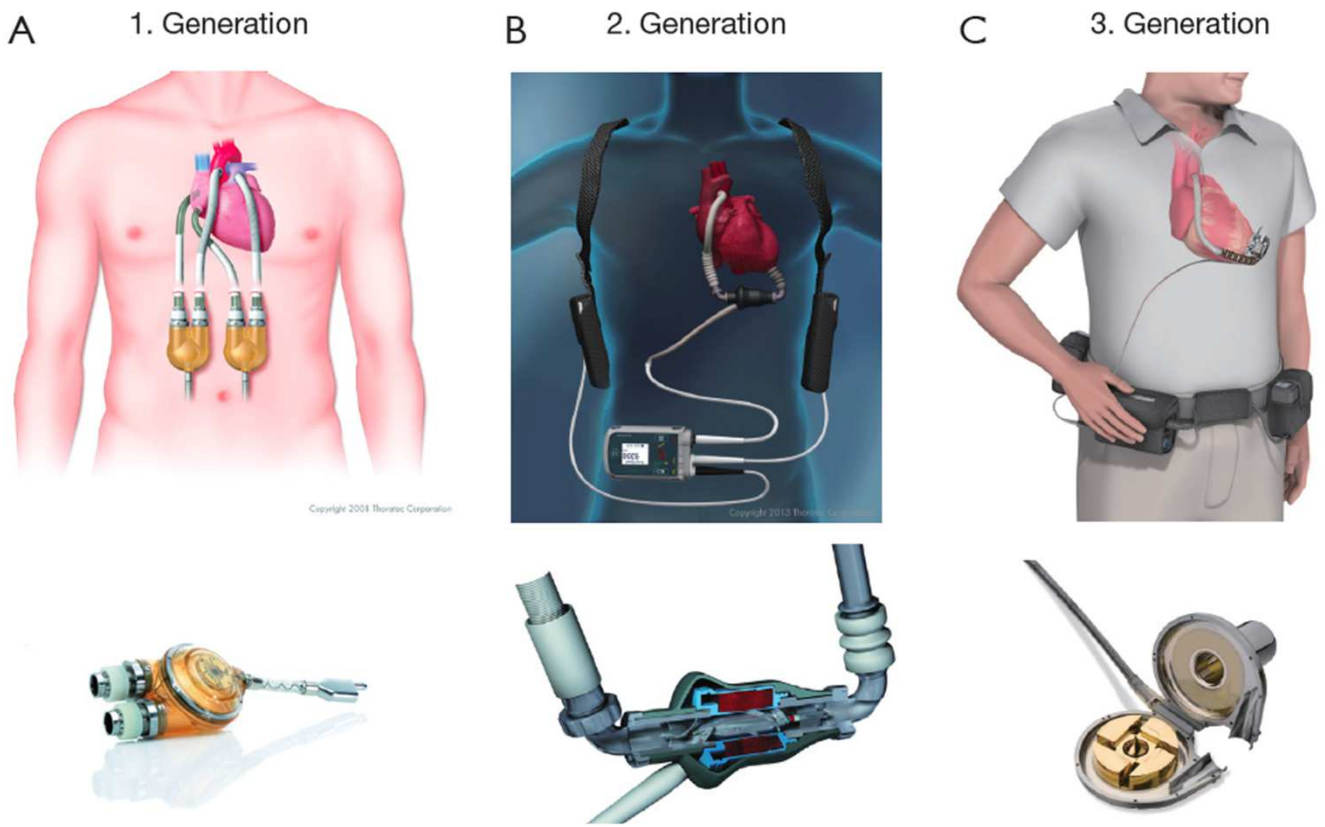
Mah D, et al. JHLT 2009

BERLIN HEART TRIAL



Fraser CD, et al. NEJM. 2012

CURRENT GENERATION OF VADS



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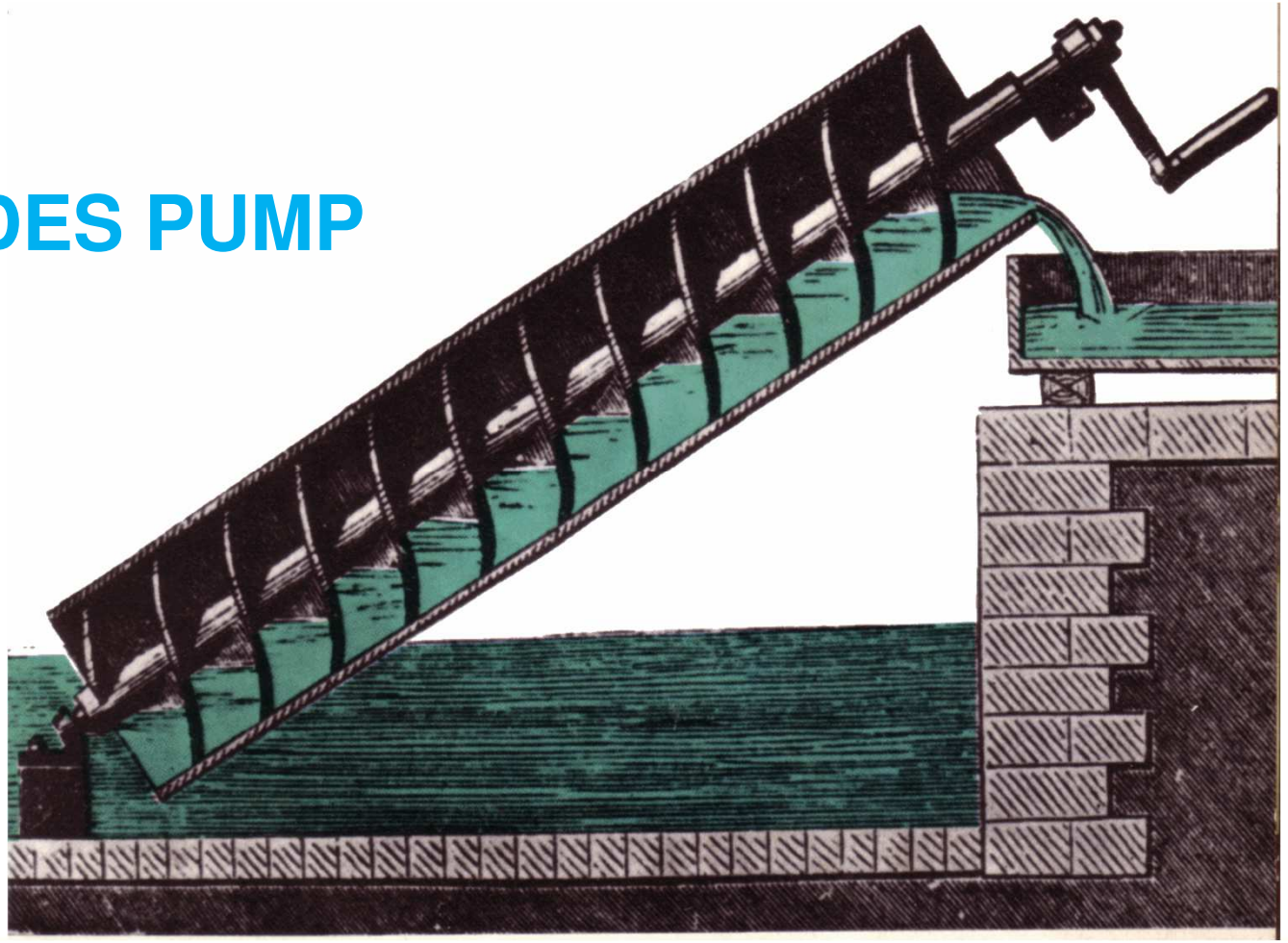
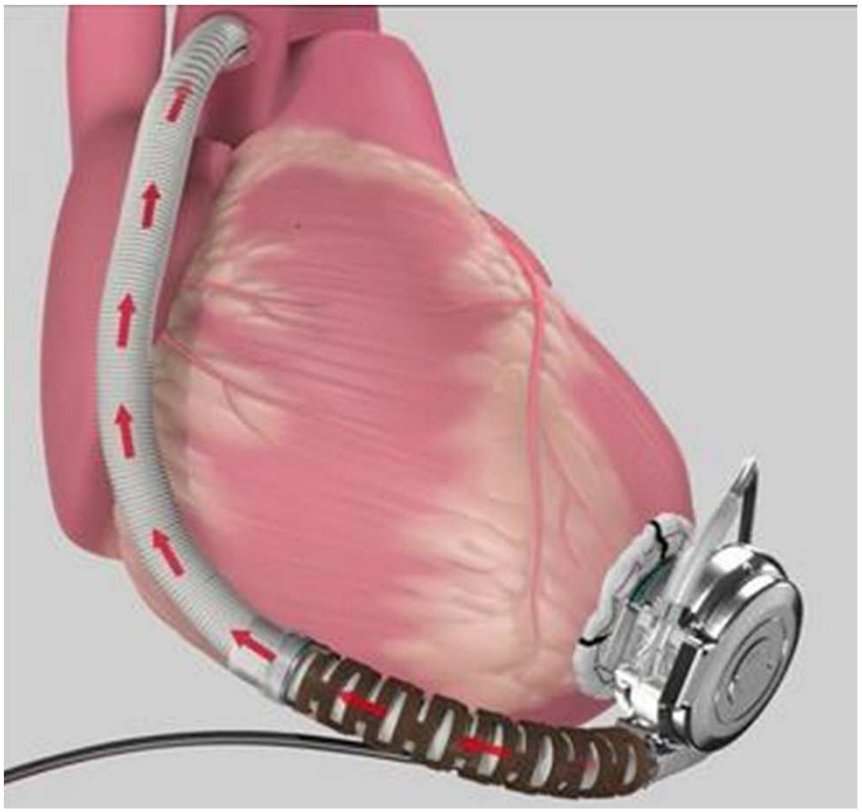
Prinzing A, et al. J Thorac Dis. 2016

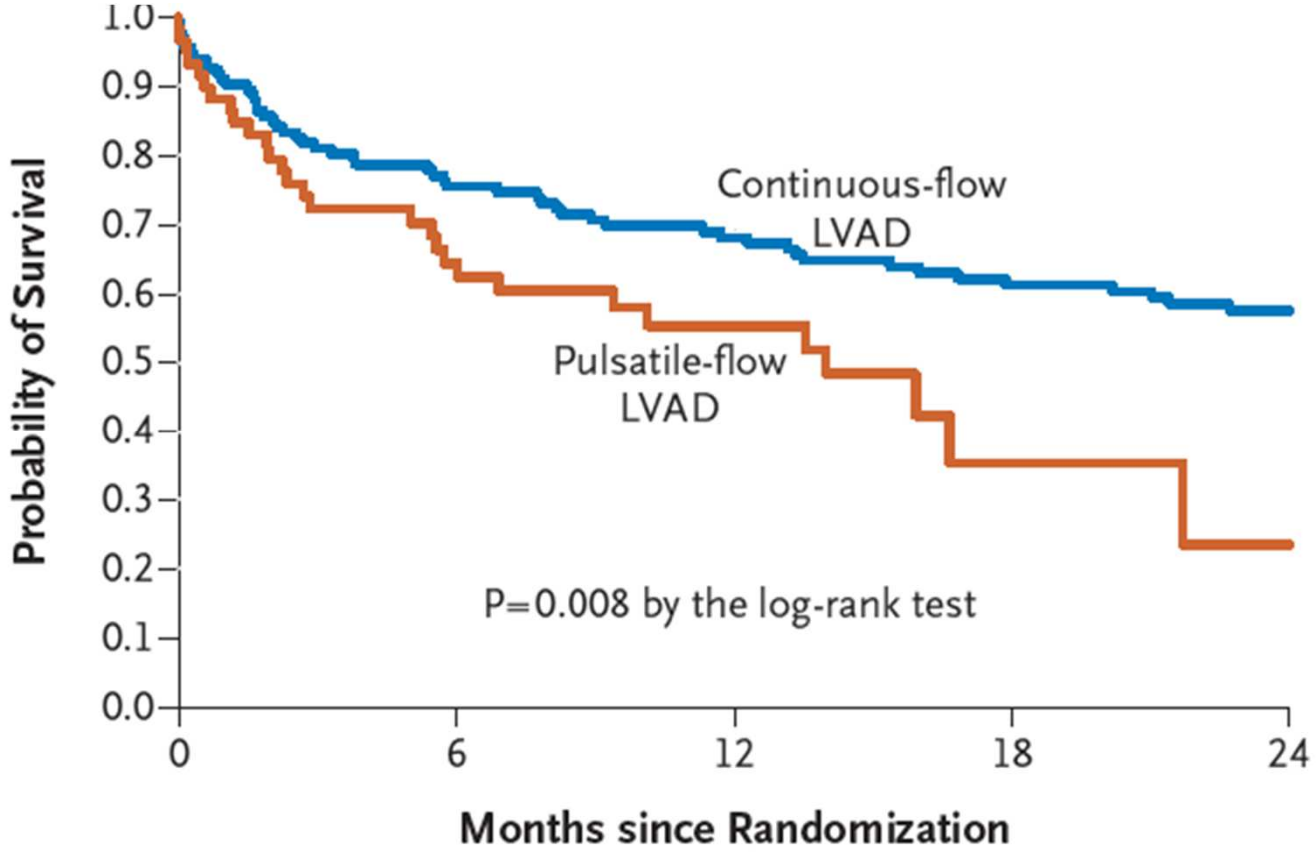
ARCHIMEDES PUMP



HEARTWARE

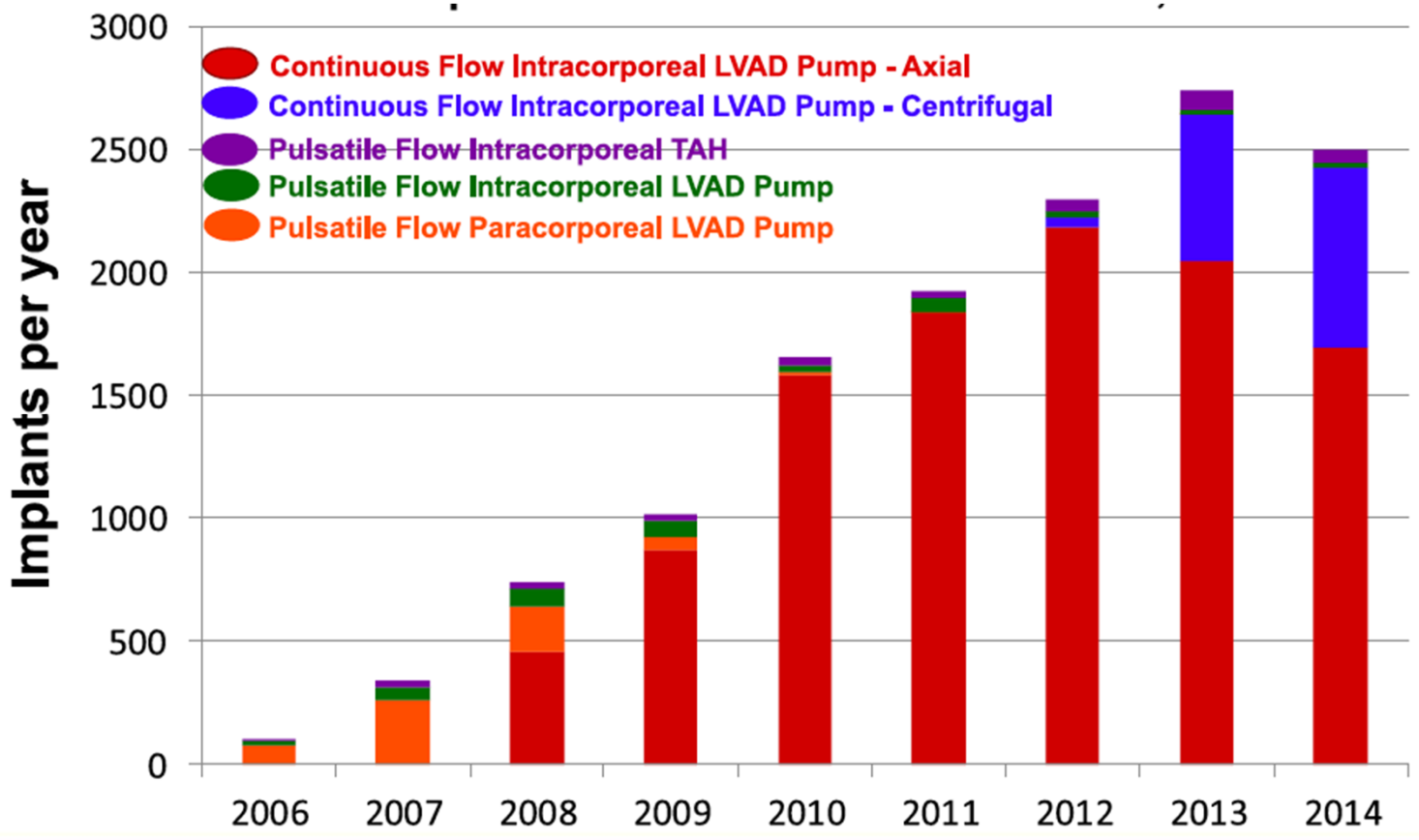


RISE OF CONTINUOUS FLOW VADS



Slaughter MS, et al. NEJM 2009

‘EXPLOSION’ OF ADULT VADS



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Kirklin JK, et al. JHLT. 2015

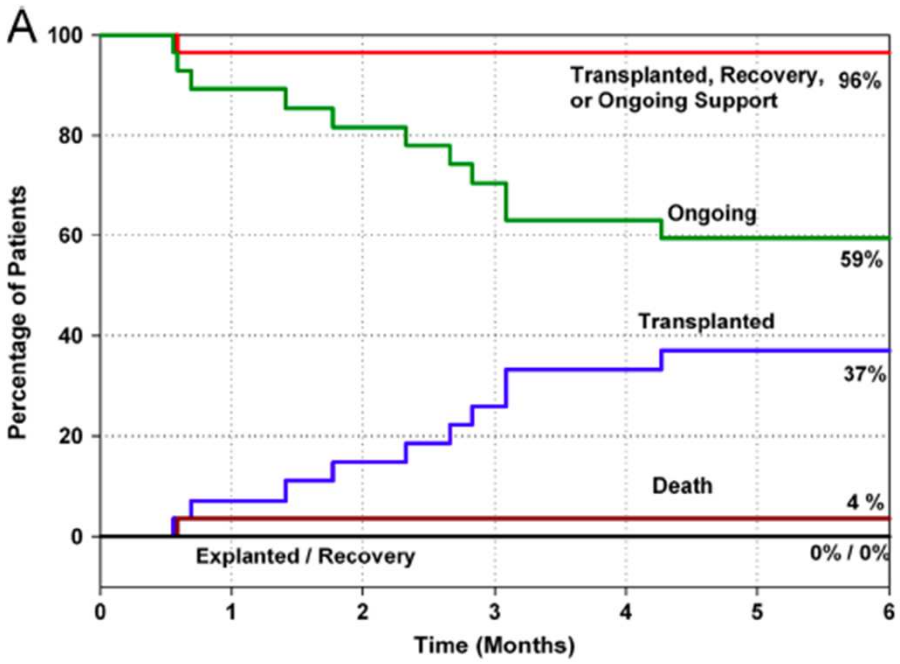
HEARTMATE II IN CHILDREN

Variable[a]	Pediatric ($n = 28$)	Young adult ($n = 359$)	p-value
Demographics			
Patients from Children's Hospital	7 (25)	0 (0)	<0.001
Females	9 (32)	113 (31)	0.942
Body surface area, m^2	1.91 (1.47–2.65)	2.08 (1.12–3.10)	0.022
Weight, kg	76.1 (50–132.8)	87.7 (29.0–177.5)	0.025
Race and ethnicity			
White	12 (43)	198 (56)	0.441
Black	14 (43)	122 (34)	
Hispanic	5 (18)	32 (9)	
Asian	0 (0)	8 (2)	
Other	3 (11)	21 (6)	
Not reported	1 (4)	10 (3)	
Primary diagnosis			
Congenital heart disease	2 (7)	8 (2)	0.158
Cardiomyopathy	25 (89)	347 (97)	<0.022
Other	1 (4)	3 (<1)	0.260

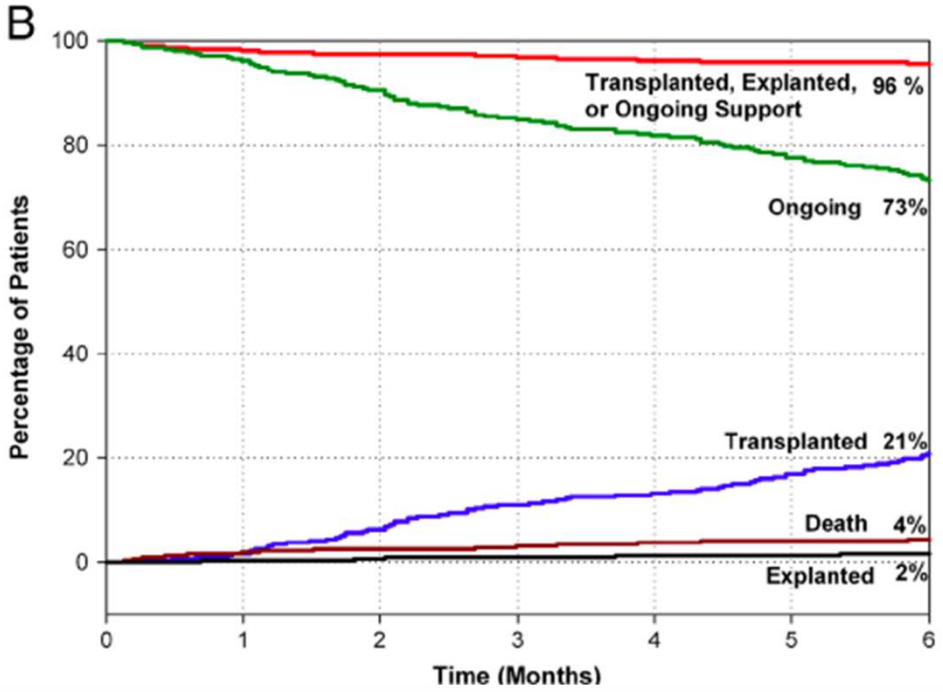
Cabrera AG, et al. JHLT 2013

HEARTMATE II IN CHILDREN

Pediatric Patients



Young Adult Patients



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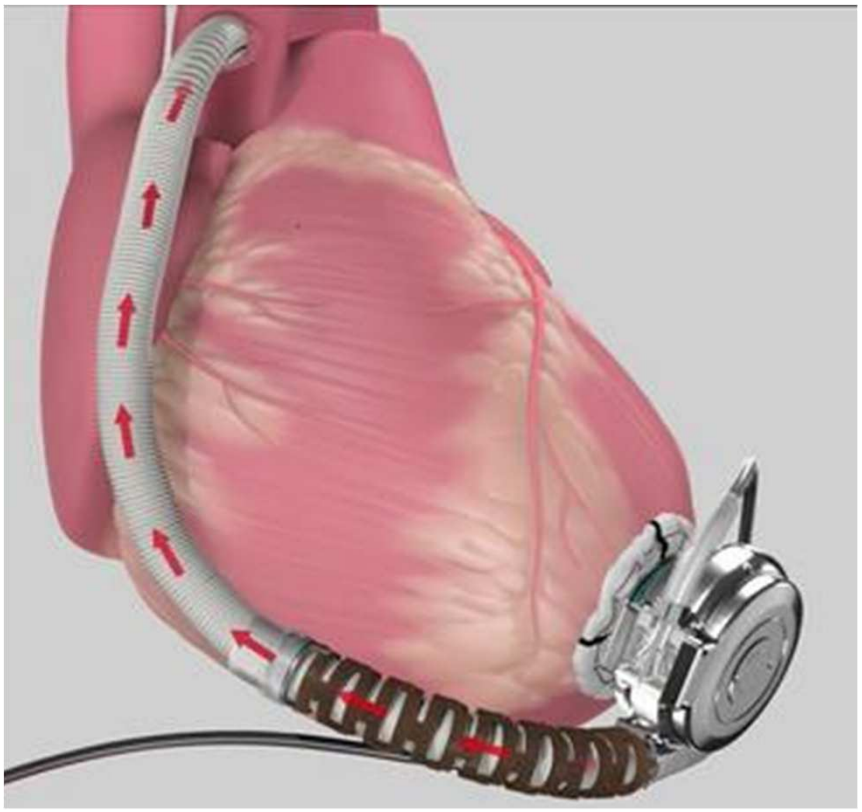
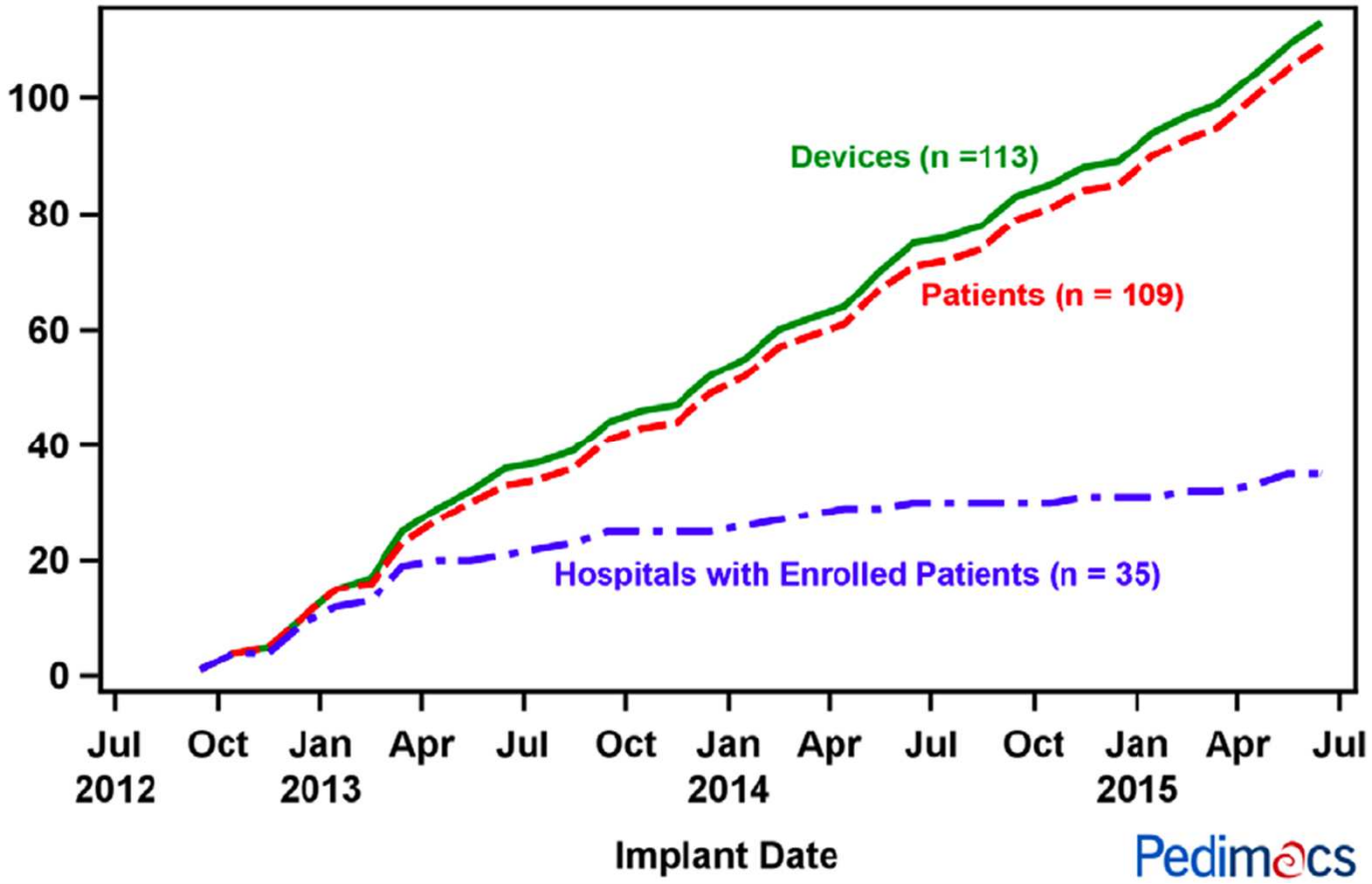
Cabrera AG, et al. JHLT 2013

HEARTWARE



CONTINUOUS FLOW VADS



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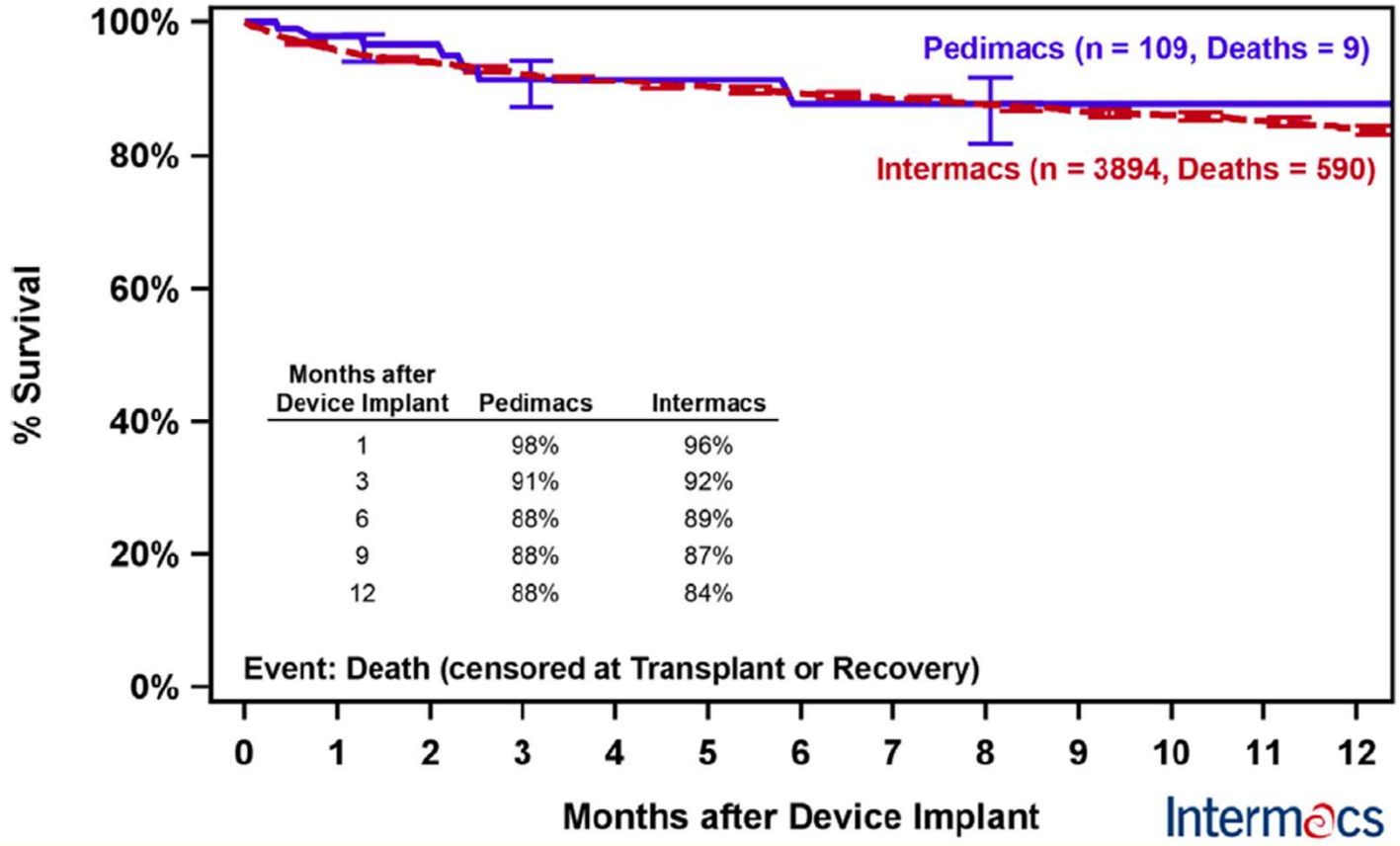
Rossano JW, et al. JHLT 2016

CONTINUOUS FLOW VADS IN CHILDREN

Characteristics	PediMACS (n = 109)	INTERMACS (n = 3,894)
Age, median [years (range)]	15 (0.6–18.9)	56 (19.0–84.1)
<6 years [n (%)]	4 (4)	NA
6–10 years [n (%)]	17 (16)	NA
11–18 years [n (%)]	88 (81)	NA
19–30 years [n (%)]	NA	225 (6)
31–50 years [n (%)]	NA	1,088 (28)
51–70 years [n (%)]	NA	2,521 (65)
>70 years [n (%)]	NA	60 (2)
Weight, median [kg (range)]	62 (16–141)	86 (9–258)
<20 kg [n (%)]	4 (4)	2 (1)
20–40 kg [n (%)]	21 (19)	39 (1)
41–70 kg [n (%)]	47 (43)	826 (21)
70–100 kg [n (%)]	28 (26)	2,059 (53)
>100 kg [n (%)]	9 (8)	963 (25)

Rossano JW, et al. JHLT 2016

SURVIVAL ON CONTINUOUS FLOW VADS



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ADVERSE EVENTS

	PediMACS (n = 109)				INTERMACS (n = 3,894)			
Adverse event type	Early events	Early event rate	Late events	Late event rate	Early events	Early event rate	Late events	Late event rate
Arterial non-CNS thromboembolism	2	0.9	0	0.0	45	0.4	9	0.03
Bleeding	31	14.2	6	2.2	1,342	12.8	884	2.7
Cardiac arrhythmia	15	6.9	2	0.8	1,031	9.8	370	1.1
Device malfunction	6	2.8	10[a]	3.7[a]	261	2.5	390[a]	1.1[a]
Hepatic dysfunction	4	1.8	0	0.0	110	1.0	49	0.2
Infection	28	12.9	12	4.5	1,319	12.5	1,267	3.9
Myocardial infarction	0	0.0	0	0.0	4	0.04	9	0.03
Neurologic dysfunction	9	4.1	2	0.8	433	4.1	425	1.3
Other serious adverse event	15[a]	6.9[a]	3	1.1	1,322[a]	12.6[a]	612	1.9
Pericardial drainage	9[a]	4.1[a]	0	0.0	148[a]	1.4[a]	7	0.02
Psychiatric episode	9[a]	4.1[a]	0	0.0	192[a]	1.8[a]	81	0.2
Rehospitalization	30	13.8	44	16.5	2,077	19.7	5,281	16.2
Renal dysfunction	6	2.8	1	0.4	353	3.4	115	0.3
Respiratory failure	14	6.4	0	0.0	633	6.0	173	0.5
Venous thromboembolism	1	0.5	0	0.0	114	1.1	12	0.04
Wound dehiscence	0	0.0	1	0.4	38	0.4	13	0.04

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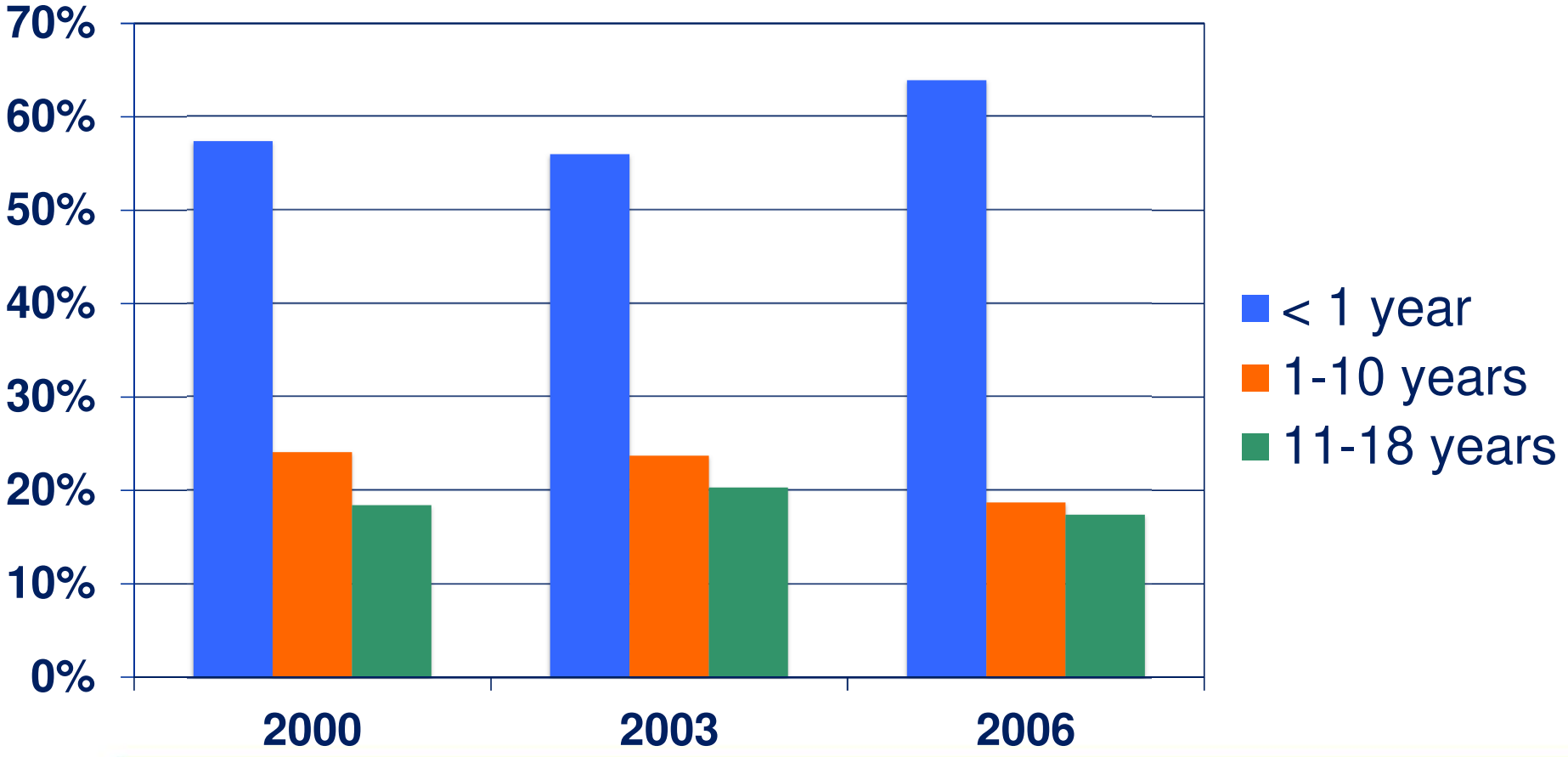
AGE AT ADMISSION



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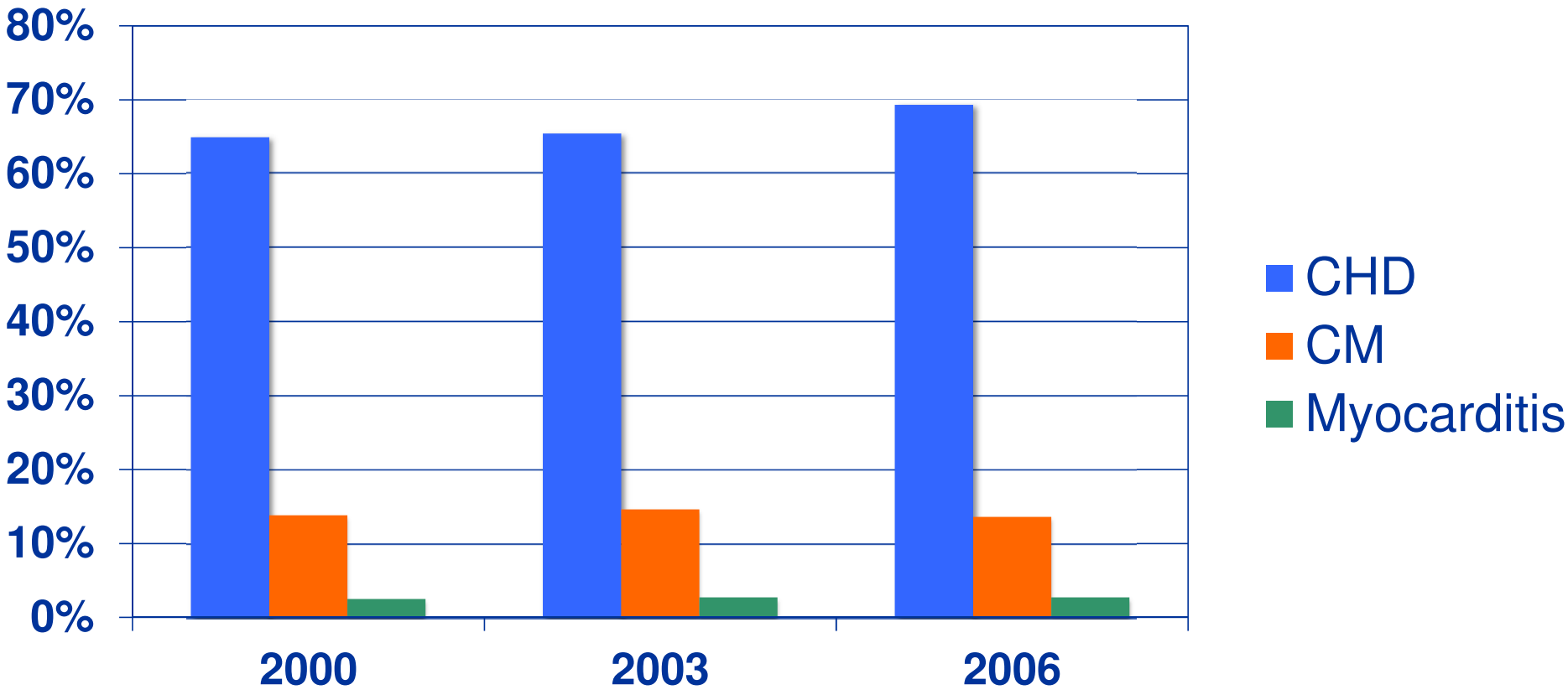
DISEASE MATTERS



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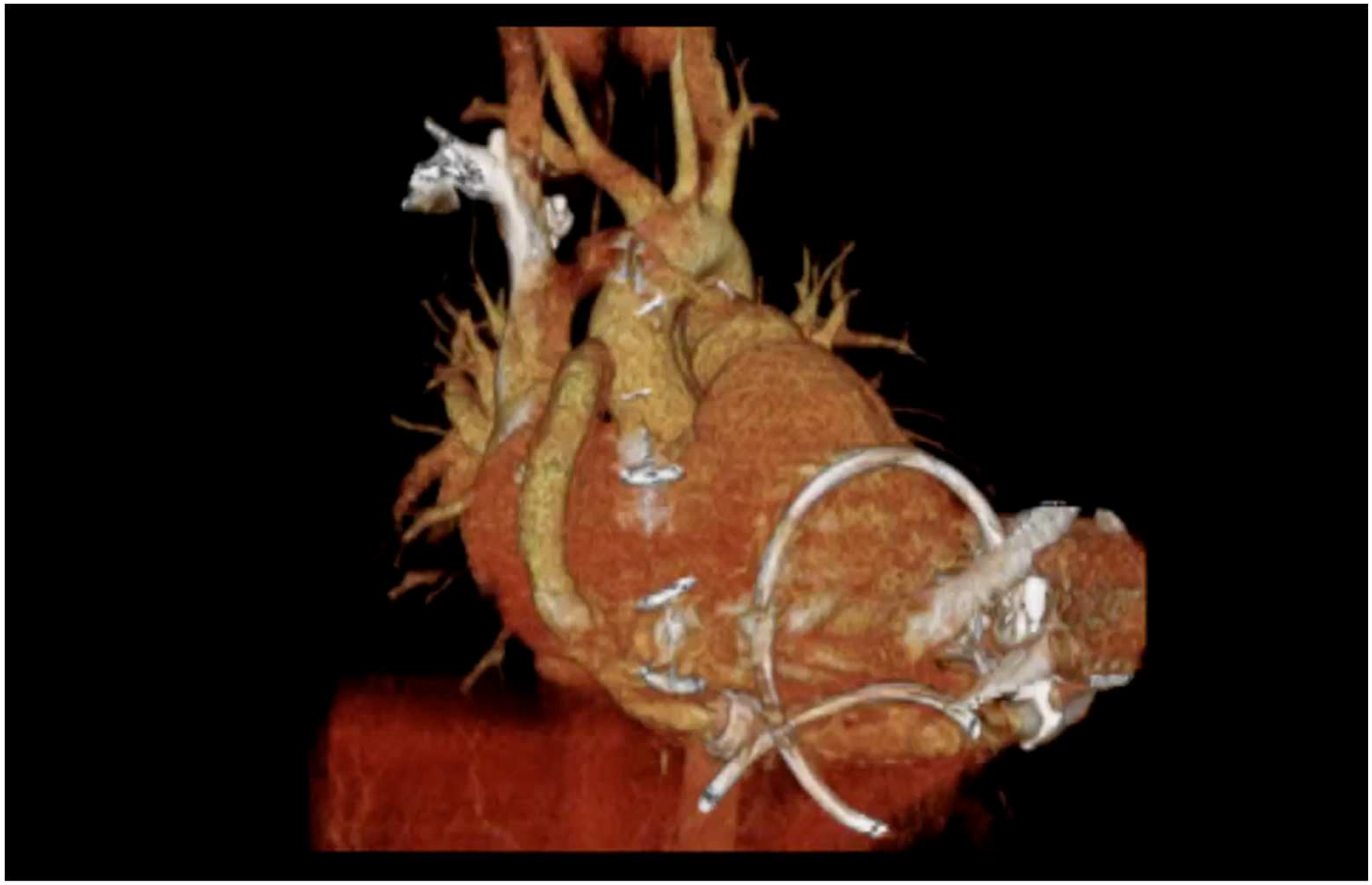
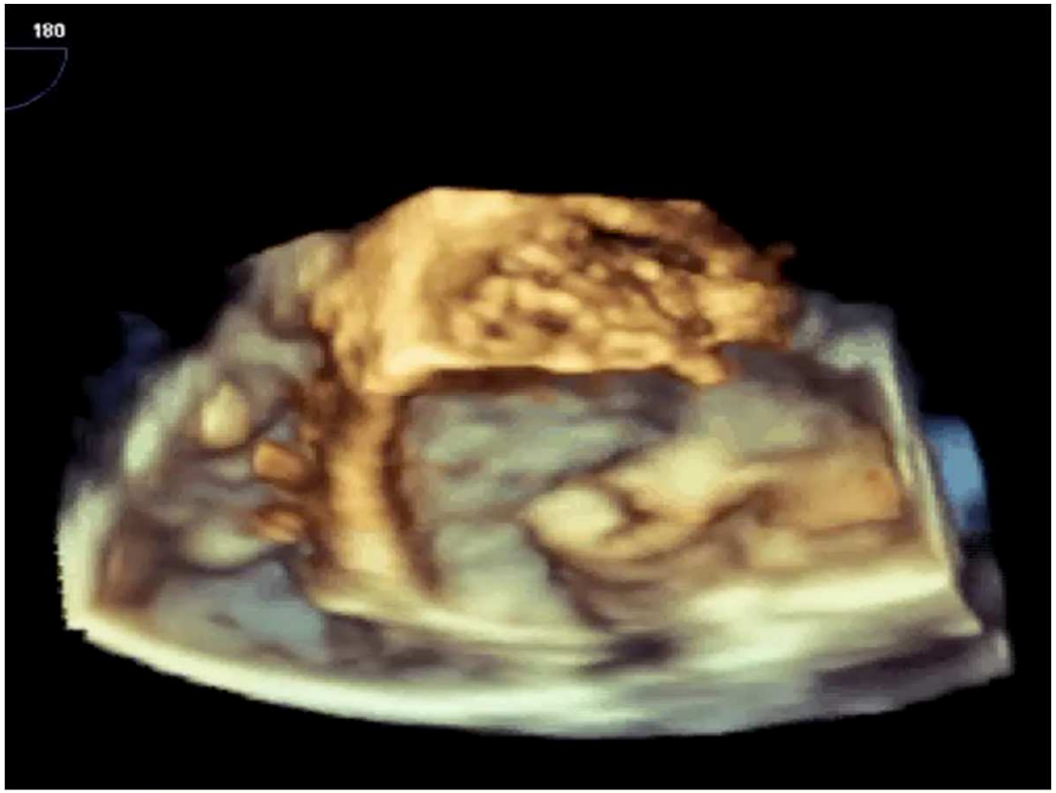
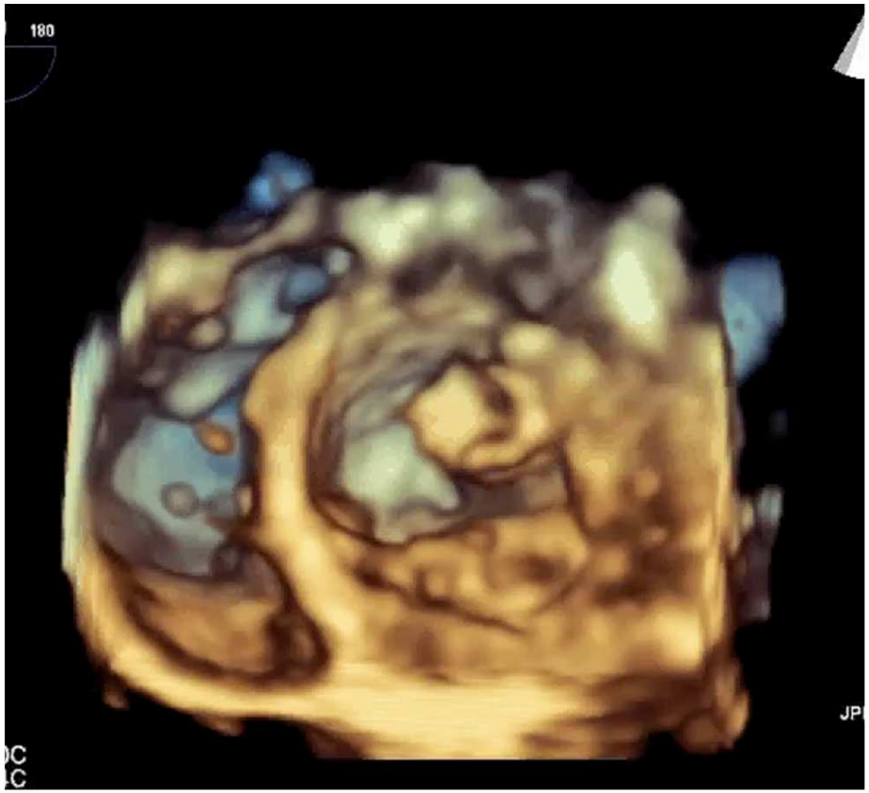
FIT STUDIES



INTRAOPERATIVE ECHOCARDIOGRAM





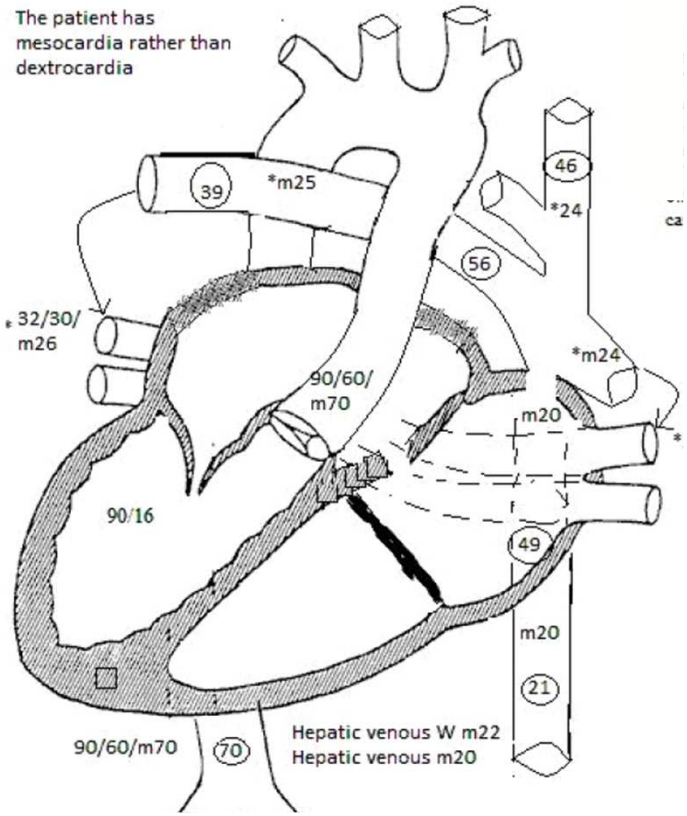
INNOVATIVE SURGERY

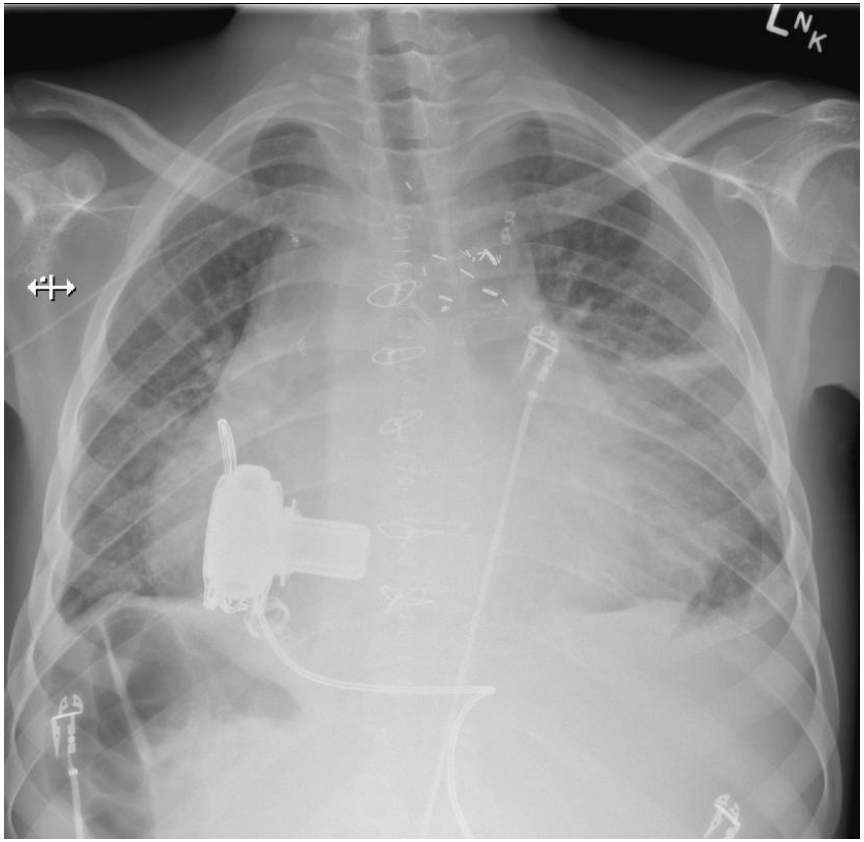
Systemic Atrioventricular Valve Excision and Ventricular Assist Devices in Pediatric Patients

Deipanjan Nandi, MD, Kelley D. Miller, CPNP, Carley M. Bober, CRNP, Tami M. Rosenthal, MBA, Lisa M. Montenegro, MD, Joseph W. Rossano, MD, J. William Gaynor, MD, and Christopher E. Mascio, MD

Division of Cardiology, Department of Perfusion Services, Department of Anesthesia & Critical Care Medicine, and Division of Cardiothoracic Surgery, Cardiac Center, The Children's Hospital of Philadelphia, Perelman School of Medicine at the University of Pennsylvania, Philadelphia, Pennsylvania

FONTAN SUPPORT

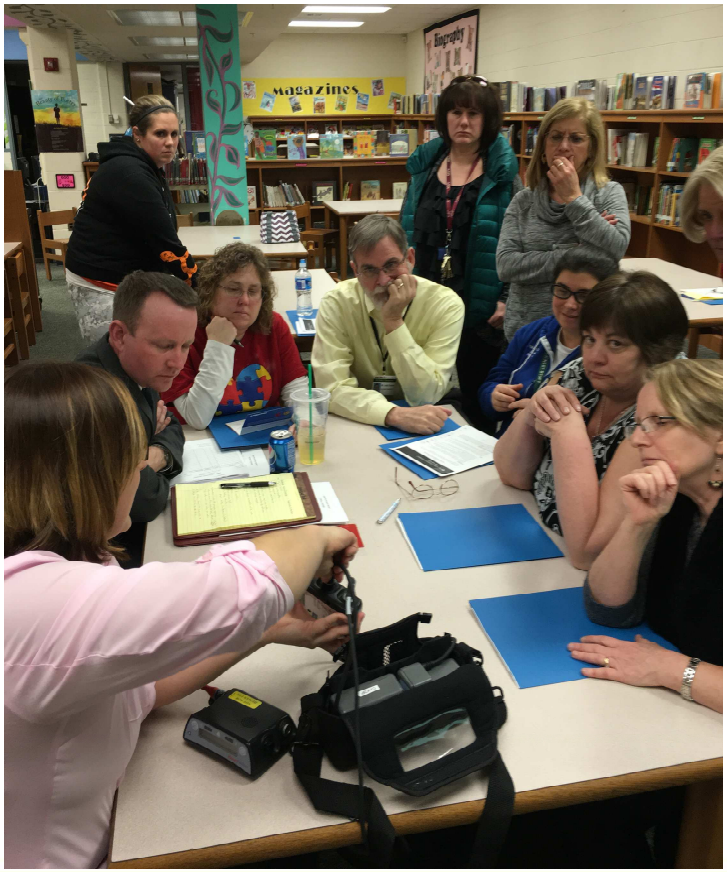




20 mm

FONTAN PATIENT ON HEARTWARE

SCHOOL TRAINING



CONCLUSION

- Tremendous advancements in mechanical circulatory support for children over the last decade

- Off-label use of continuous flow devise is common in the management of advanced heart failure in children
  - Excellent outcomes

- Better support options are needed for small children and those with complex congenital heart disease

Thank You

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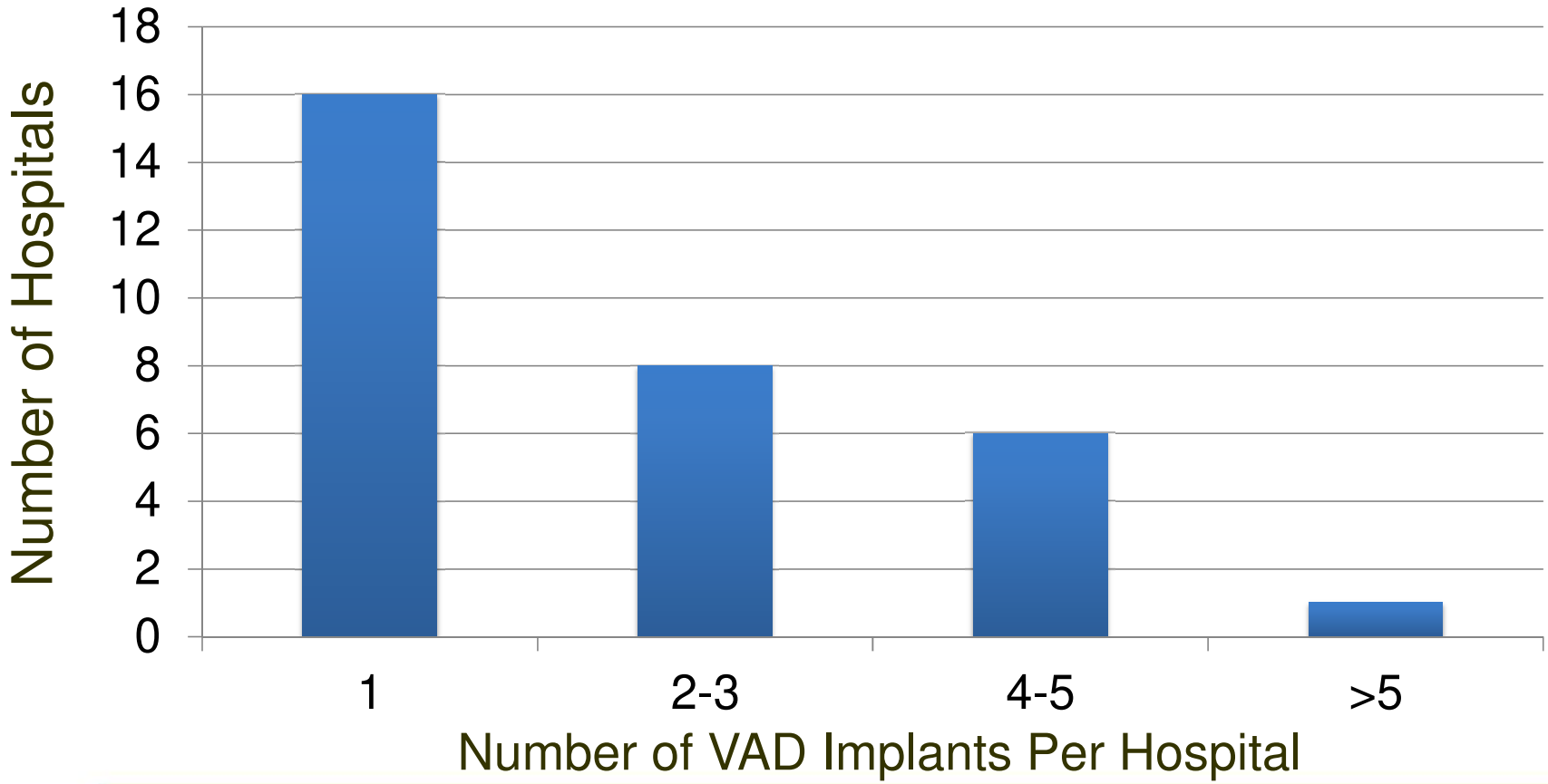
CONTINUOUS FLOW VADS AND HOSPITAL VOLUME



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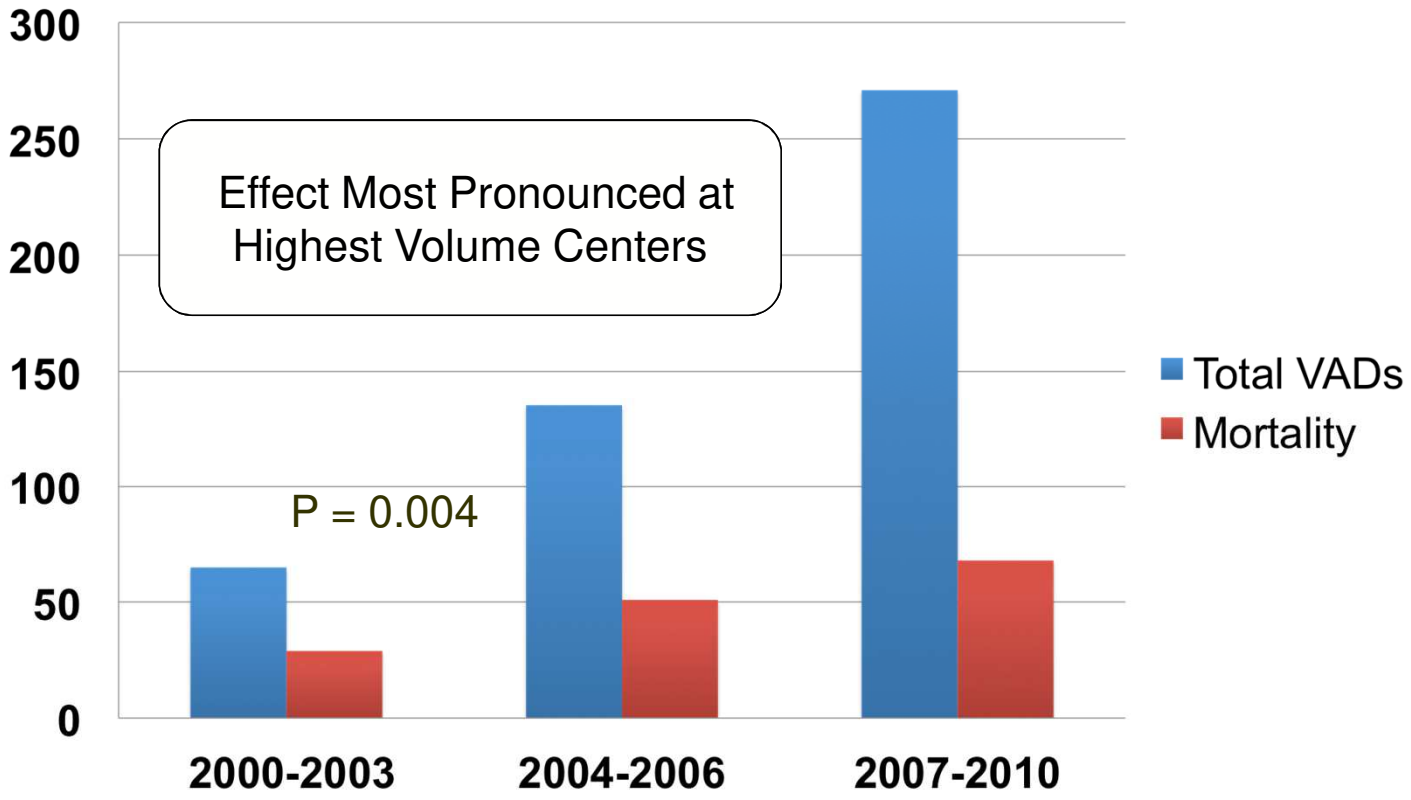
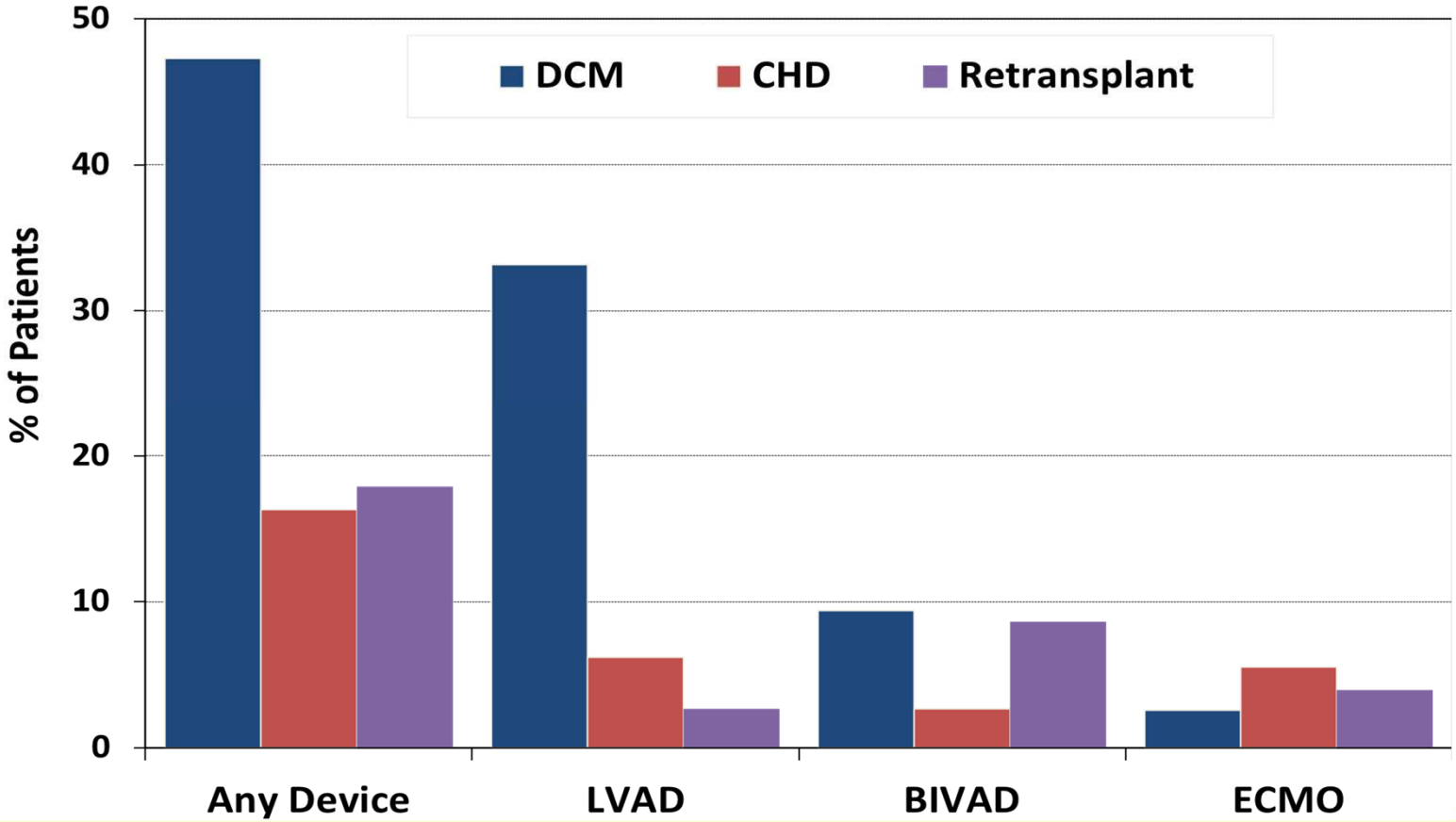
Rossano JW, et al. JHLT 2016

VAD UTILIZATION & OUTCOMES



Mansfield RM, et al. PCCM 2015

WORLDWIDE PHENOMENON



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