

The realities of donor heart availability in Australia and NZ

**Peter Ruygrok
Cardiologist**

Queenstown, December 2017

Topics to cover

- Update on NZ heart transplant programme
- An ACHD recipient story
- Donor limitation/constraints
- Information required from the donor hospital
- Acceptance criteria
- Choosing the best recipient & maximising the use of donor hearts offered

NZ Demographics – now 324

▪ Number		252
▪ Gender	Male	201 (80%)
	Female	51
▪ Age (years)	Mean	42.5
	Range	5 - 64
▪ Domicile	Northern region	98 (39%)
	Midland (NI)	49 (19%)
	Central NZ*	53 (21%)
	Southern region	52 (21%)

*includes Nelson/Blenheim

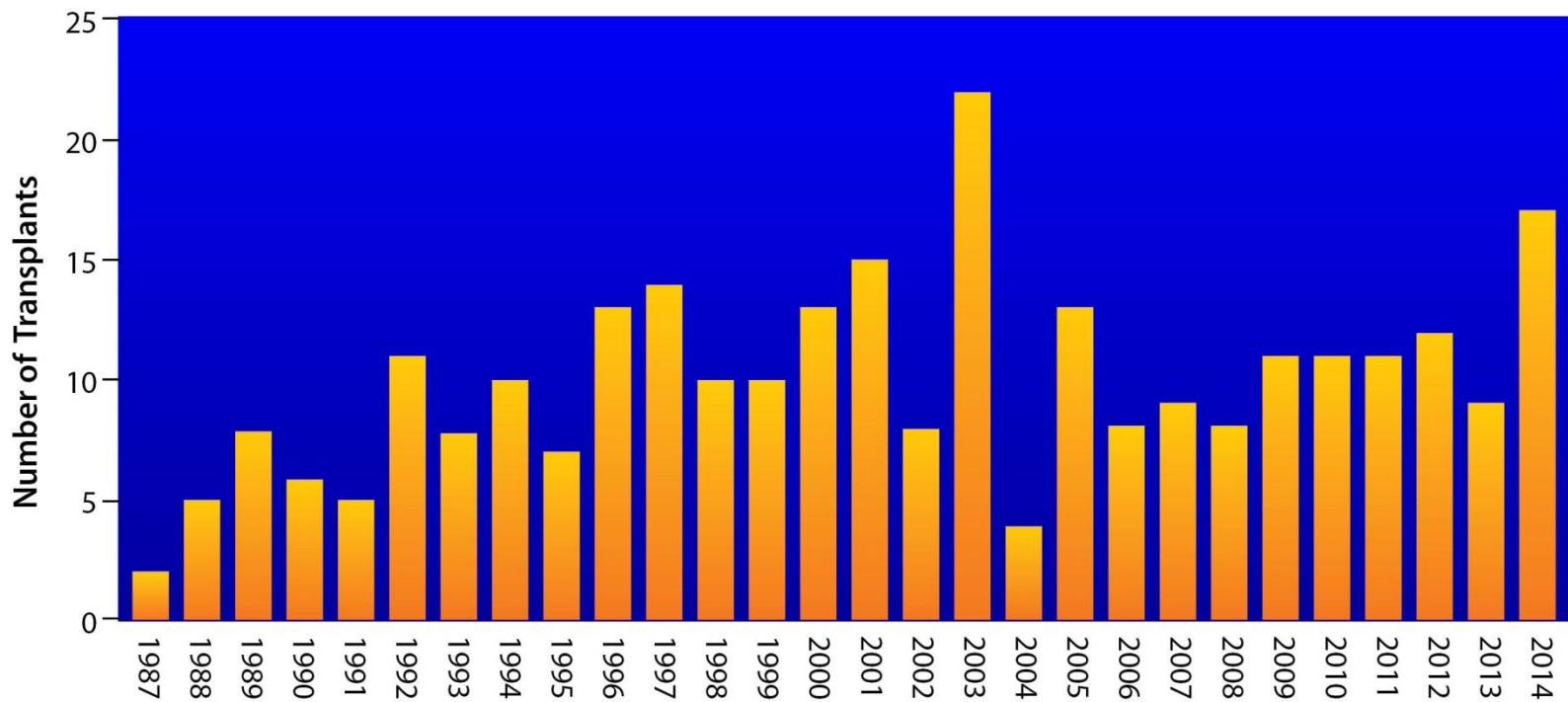
2017 – 21 heart transplants NZ

- 9 Dilated cardiomyopathy*
- 3 Adult congenital
- 5 Paediatric (1 CHD)
- 2 Rheumatic heart disease
- 1 HOCM
- 1 Ischaemic cardiomyopathy

*1x deceased

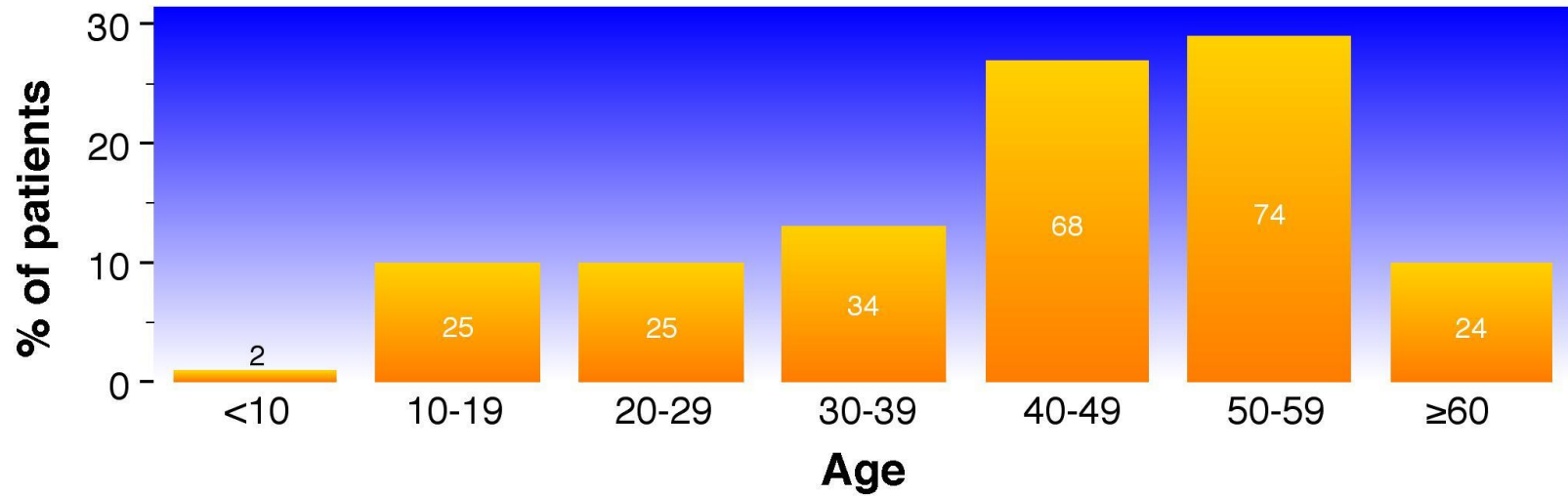
6 (29%) NZ Maori

Heart Transplants in New Zealand

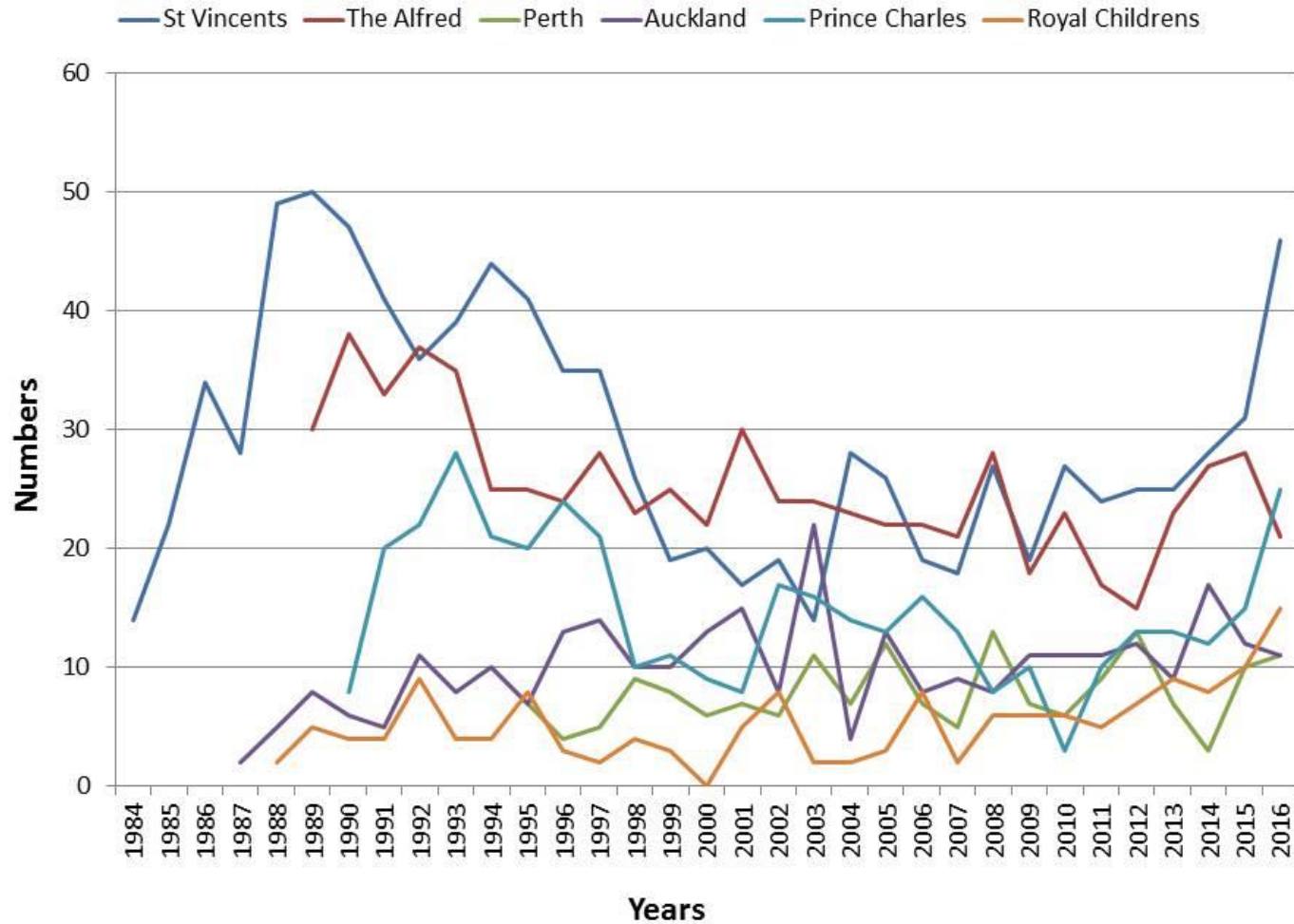


2015 - 12 , 2016 - 11, 2017 – 21 to date

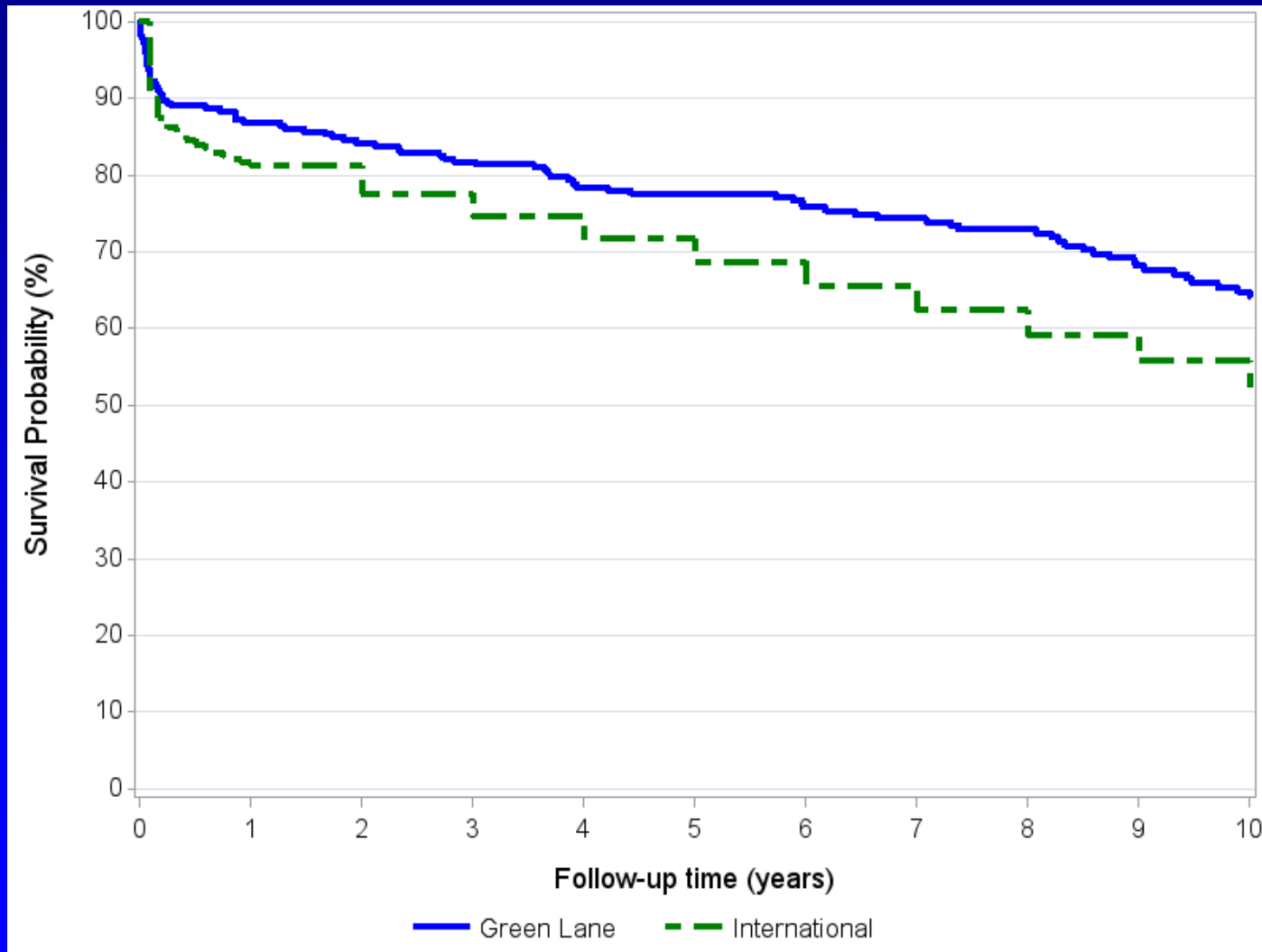
Age distribution of recipients



Heart transplants - Australasia



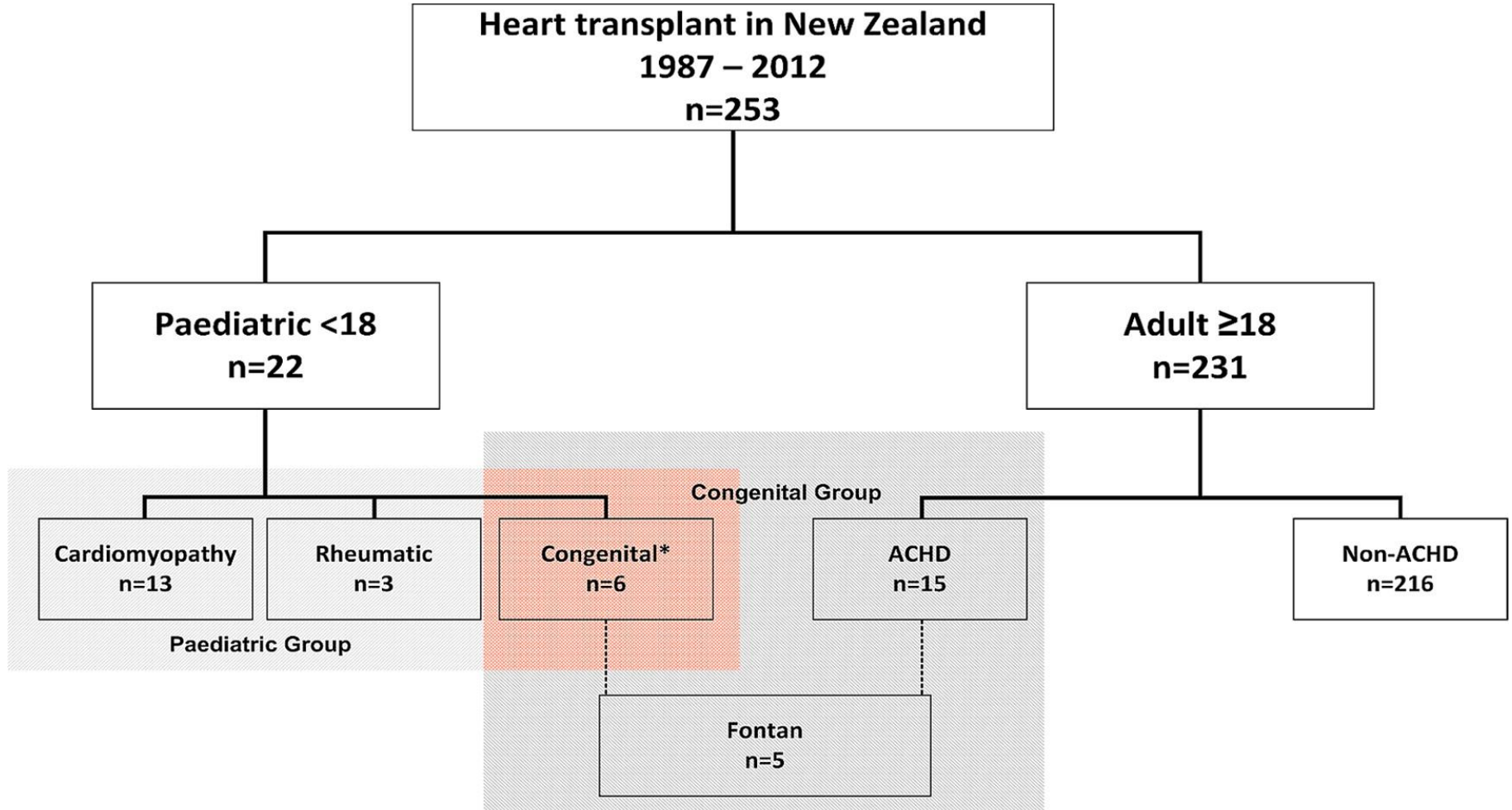
Heart transplant survival 1987-2015



Extending the boundaries

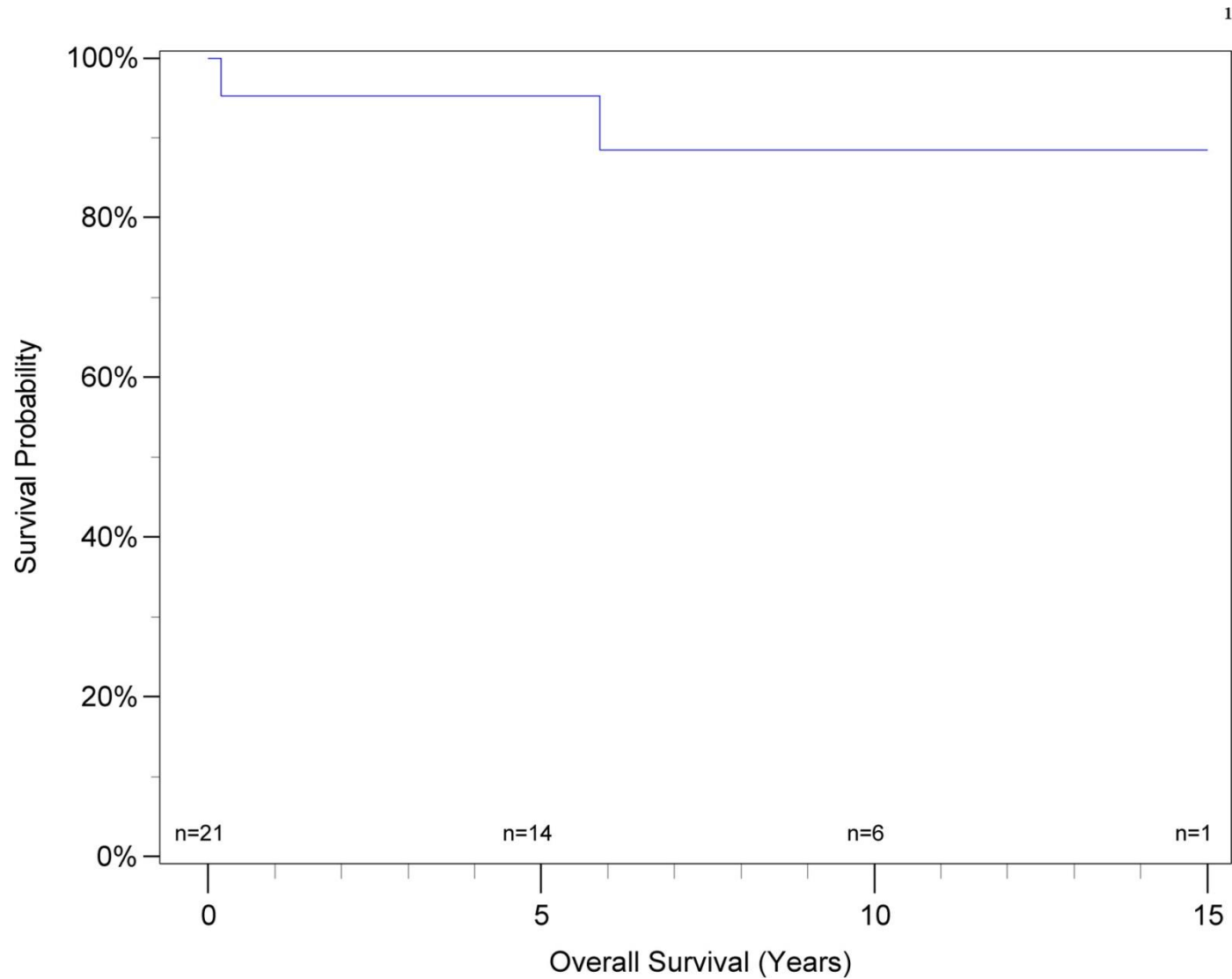
- Complex congenital heart disease
- Older recipients
- **Older / more marginal donors**
- Paediatric transplantation
- Combined heart / kidney transplantation
- Combined heart / liver transplantation
- Re-transplantation
- Left ventricular assist devices / ECMO

Flow diagram displaying the identification and definition of the study population



*Overlap of 6 patients included and analysed in both paediatric and congenital groups.

Kaplan-Meier graph showing the survival of those with congenital heart disease



Case of PS

Age - 55
Weight - 77kg
Blood group - O-

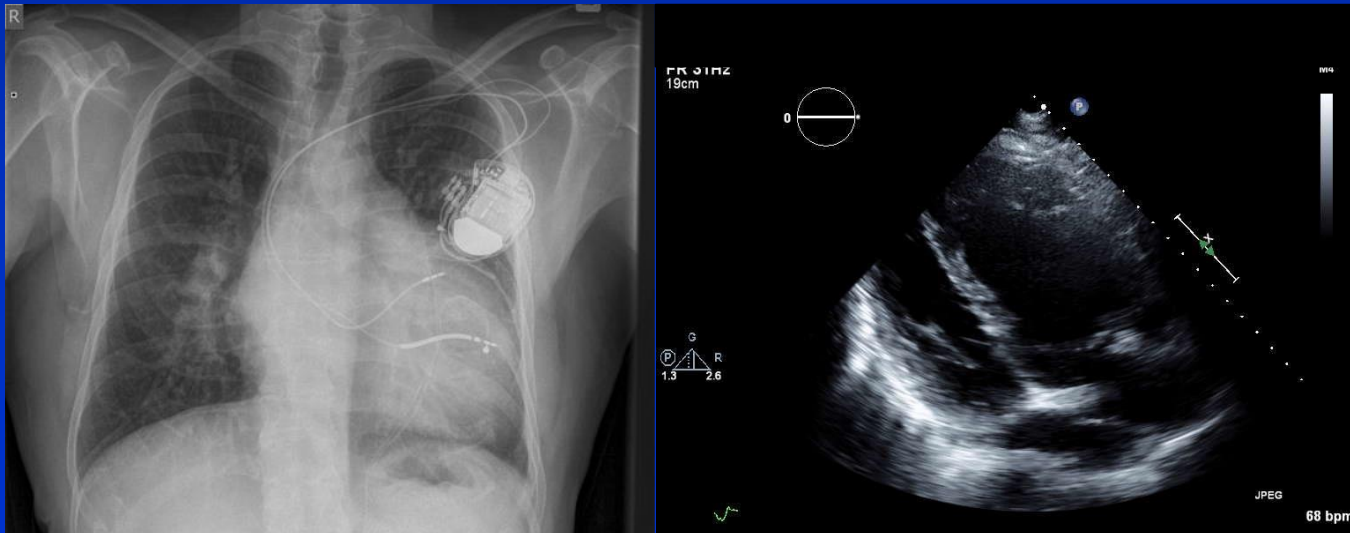
Problems:

- Congenital heart disease - D TGA
- Severe global RV (systemic) impairment, severe TR
- Surgical atrial septectomy 1962
- Previous Mustard baffle repair – 1966 – 3rd NZ Mustard – longest living survivor

Copies: The Medical Superintendent, Napier Hospital Dr B. Buckey, 294 Kennedy Road, Napier Mr Barratt-Boyes, Mr Clarke and Cardiological		Code: C.34-P
388671 3689 S	4 years	Ward 2
10.6.66	TRANSPOSITION GREAT VESSELS MUSTARD PROCEDURE	MR BARRATT-BOYES MR CLARKE
	Bypass No.956	Gen. DR SIMPSON Pump MR KERR
<u>Findings:</u>	This child had had a previous ASD created and had made reasonable progress. The pericardial space was free anteriorly but markedly obliterated over the right atrial wall and here the lung was fairly firmly adherent and very vascular with quite a lot of collaterals. The RA was also rather thin and dilated and the appendage was large. The anatomy of the heart was that of complete transposition with an anteriorly placed aorta arising from the right ventricle and with the pulmonary artery lying posteriorly and a little to the left.	

Progress

- Epicardial pacemaker leads – 1998
- Symptoms class II-III heart failure
- 1x discharge ICD – rapid atrial flutter
- Flutter ablation
- Gradually worsening symptoms of lethargy and SOB
- Steadily worsening systemic (RV) function



Progress

- May 2015 - assessed and accepted onto transplant list
- Kept under close review
- Rising PVR (PA - 77/32 46, wedge - 28 TPG - 18, PVR - 4.6 Wood units)
- Several admissions anxiety/arrhythmia/CHF

- October 2017, aged 55 underwent successful HTX – after waiting 29 months (870 days)

- **Why did it take so long?**

Wait for those with stable symptoms can be very long

Year	Number	Mean (days)	SD	Median	Range
2014	95	197	279	96	0-1638
2015	102	194	203	123	0-1027
2016	124	156	219	68	0-1268

NZ Agreement rate for donation

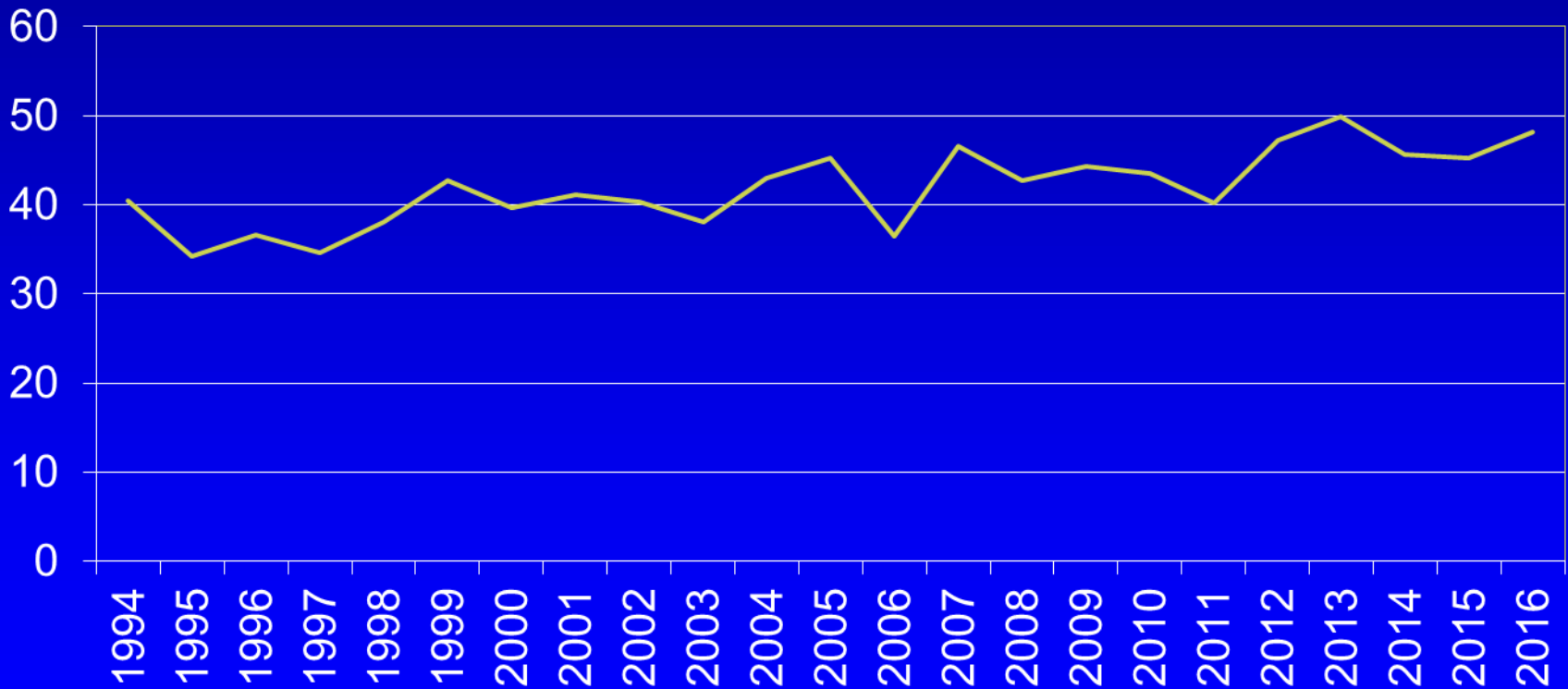
- Family agreement rate in NZ – 55% (when donation formally discussed)
- Increase in donors has occurred over last five years - despite same number of ICU deaths & brain death
- Result of more consultations with ODNZ & formal discussions with families

2016: 61 deceased organ donors, 11 heart transplants. Reasons for non-transplantation

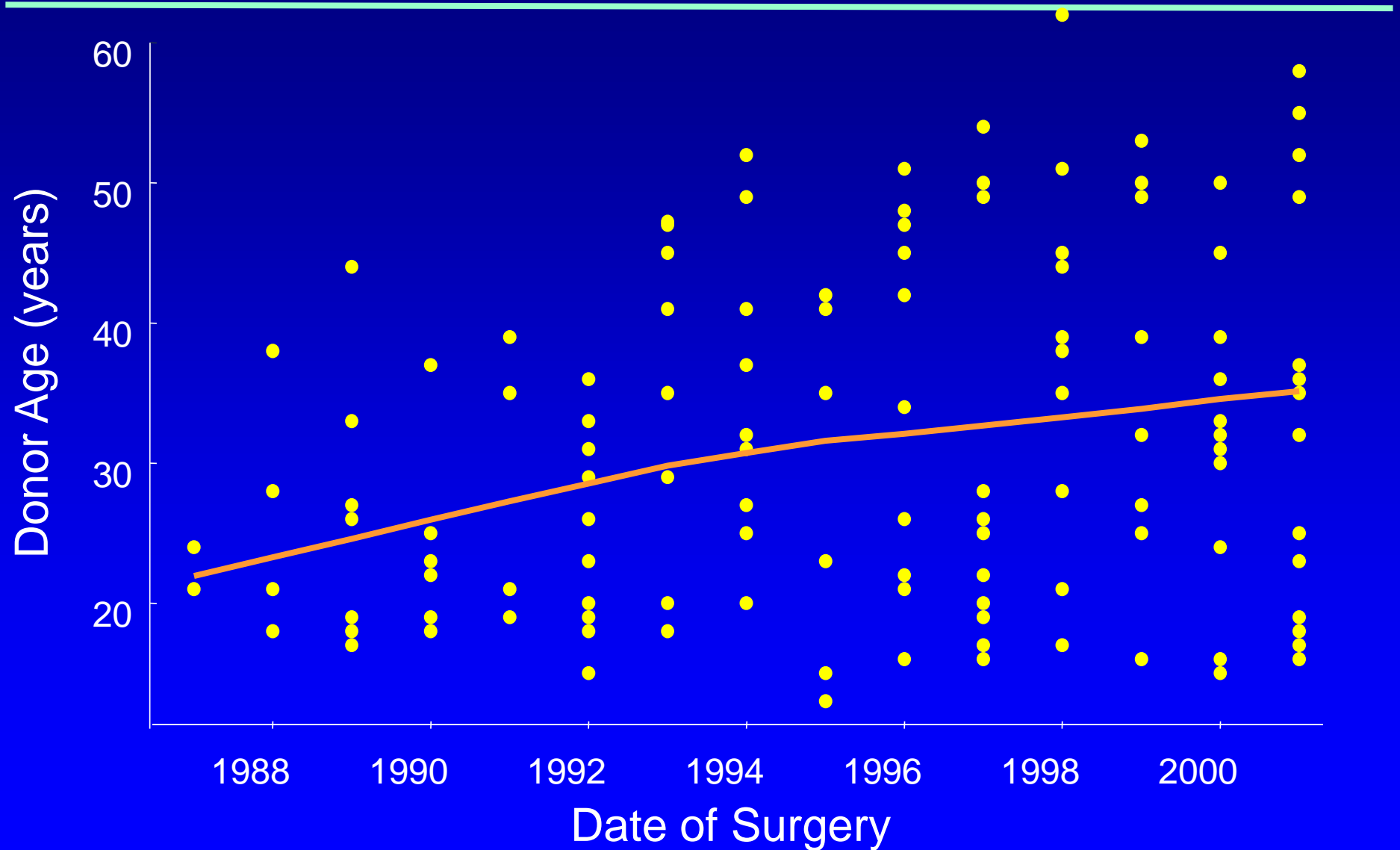
- No consent for heart
- Age > 65
- Cardiac history or risk factors
- Abnormal echo or angiogram
- Positive cross-match
- No suitable recipient
- Logistics

Mean age of all NZ donors 1994-2016

Mean age



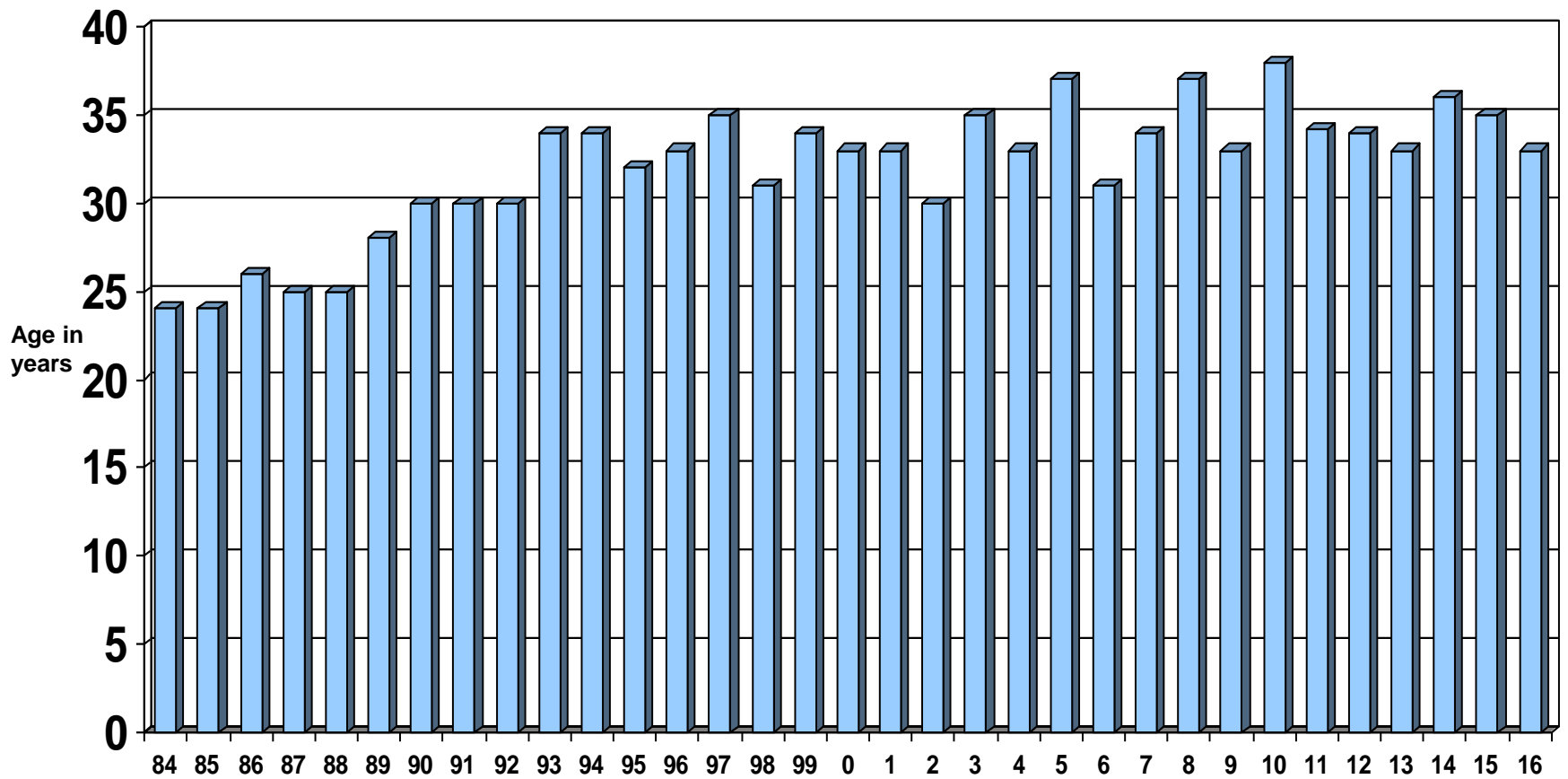
Heart donor Age Over Time – New Zealand



Oldest (early) donor heart

- Recipient was aged 51 with dilated cardiomyopathy
- Donor aged 62 (no angio)
- 19 years on:
 - Recipient aged 70
 - Donor heart aged 81 – moderate aortic stenosis

Hearts Mean Donor Age 1984 - 2016



Year

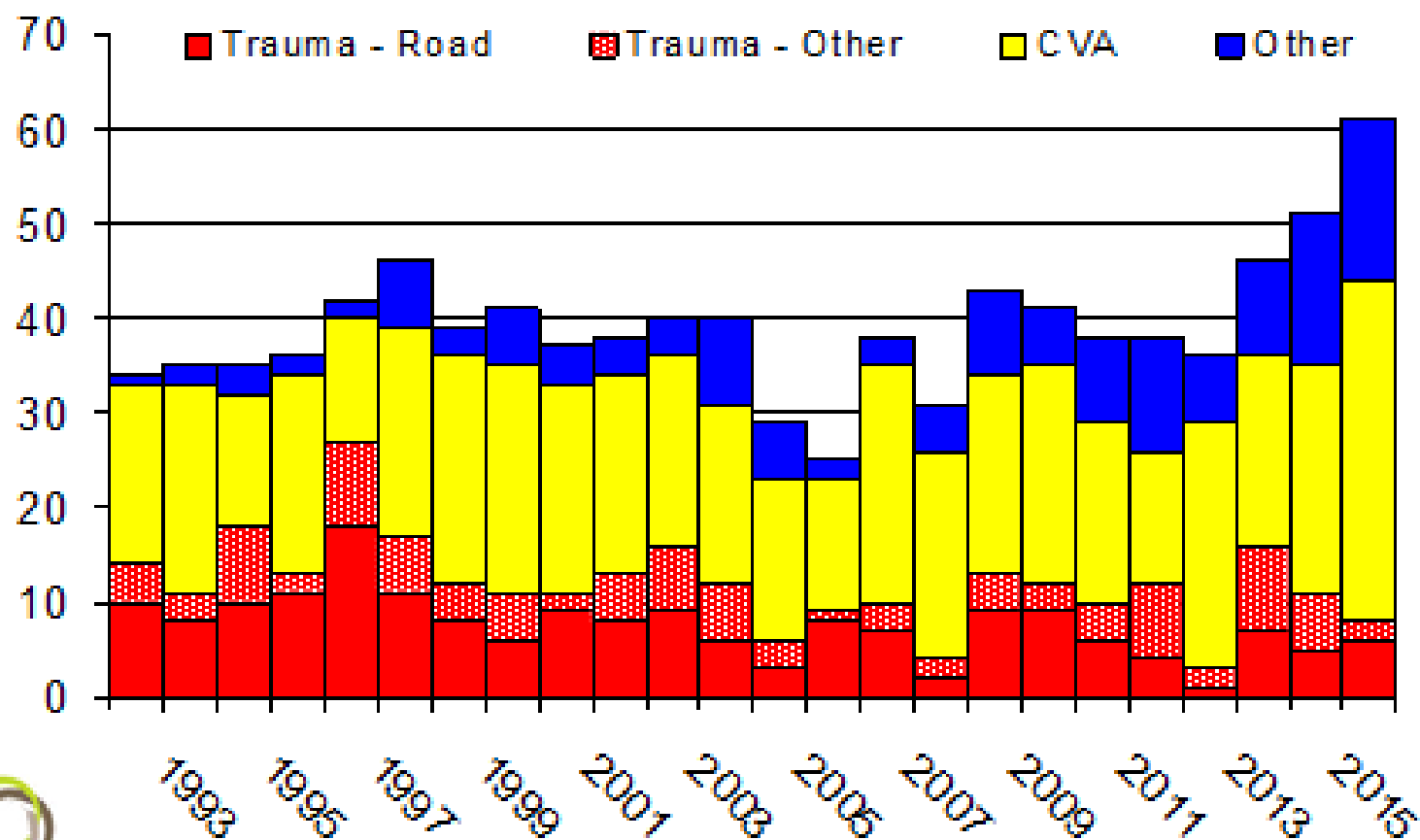
Organ donor demographics – what has changed?

- Fewer young donors from traumatic head injury – impact of: seat belts, airbags, median barriers, occupational health and safety workplace law, playground policy
- Donors from suicide, overdose
- More older donors from SAH, ICB

- More younger recipients receive hearts from older donors

Deceased donors and cause of death

1st Jan 1993 – 31st Dec 2016 (n = 942)



Donor information required

- Age
- Weight
- Blood group
- Gender
- Inotropic support
- Cardiac function function – echo
- Serology (e.g. CMV, Hep, HIV)
- Location (estimated ischaemic time)
- Cross match compatibility
- Cause of death

Choosing the recipient

- Blood Group – O to O, A to A, etc
- Body weight – Light (<65kg), Middle (65-80kg), Heavy weight (>80kg)
- LVAD (complications, duration)
- Urgency
 - At home
 - At home but frequent admissions
 - At home on ambulatory inotropes
 - In hospital on IV inotropes
 - In hospital on mechanical support
- Other: PVR, gender mismatch, socio-ethical

Donor angiography – greater number of older donors

Coronary angiogram may be requested in older donors with CVD risk factors

- donation offered or requested
- mustn't compromise the donation of other organs
- Cath lab same building/site as ICU

Accepting a donor

- Age \leq 60 – risk of occult coronary disease (40% of NZ'ers die from CVD)
- Echocardiogram for cardiac function – consider hormonal resus (ICU management)
- Amount of inotropic support
- Location of donor hospital – estimated ischaemic time

- Adequate pool of potential recipients
- Logistics

Waiting list

Age	Gender	Weight	Blood group	PVR	Comment
36	M	heavy	A+	normal	Heart /kidney redo
31	F	light	O+	N/A	Heart/lung
55	M	light	A+	high	
45	F	light	A+	normal	redo
52	M	middle	B+	int	redo
64	M	heavy	O+	high	redo
44	F	light	O+	high	redo
56	M	middle	A+	int	redo
55	M	heavy	AB+	int	redo
27	M	light	B+	normal	

Donor: blood group A

Age	Gender	Weight	Blood group	PVR	Comment
36	M	heavy	A+	normal	Heart /kidney redo
31	F	light	O+	N/A	Heart/lung
55	M	heavy	A+	high	
45	F	light	A+	normal	redo
52	M	middle	B+	int	redo
64	M	heavy	O+	high	redo
44	F	light	O+	high	redo
56	M	middle	A+	int	redo
55	M	heavy	AB+	int	redo
27	M	light	B+	normal	

Donor: blood group A, weight 65 kg

Age	Gender	Weight	Blood group	PVR	Comment
36	M	heavy	A+	normal	Heart /kidney redo
31	F	light	O+	N/A	Heart/lung
55	M	heavy	A+	high	
45	F	light	A+	normal	redo
52	M	middle	B+	int	redo
64	M	heavy	O+	high	redo
44	F	light	O+	high	redo
56	M	middle	A+	int	redo
55	M	heavy	AB+	int	redo
27	M	light	B+	normal	

Summary

- Update on NZ heart transplant programme
- A recipient story
- Donor limitations/constraints
- Information required from the donor hospital
- Choosing the best recipient & maximising the use of donor hearts offered



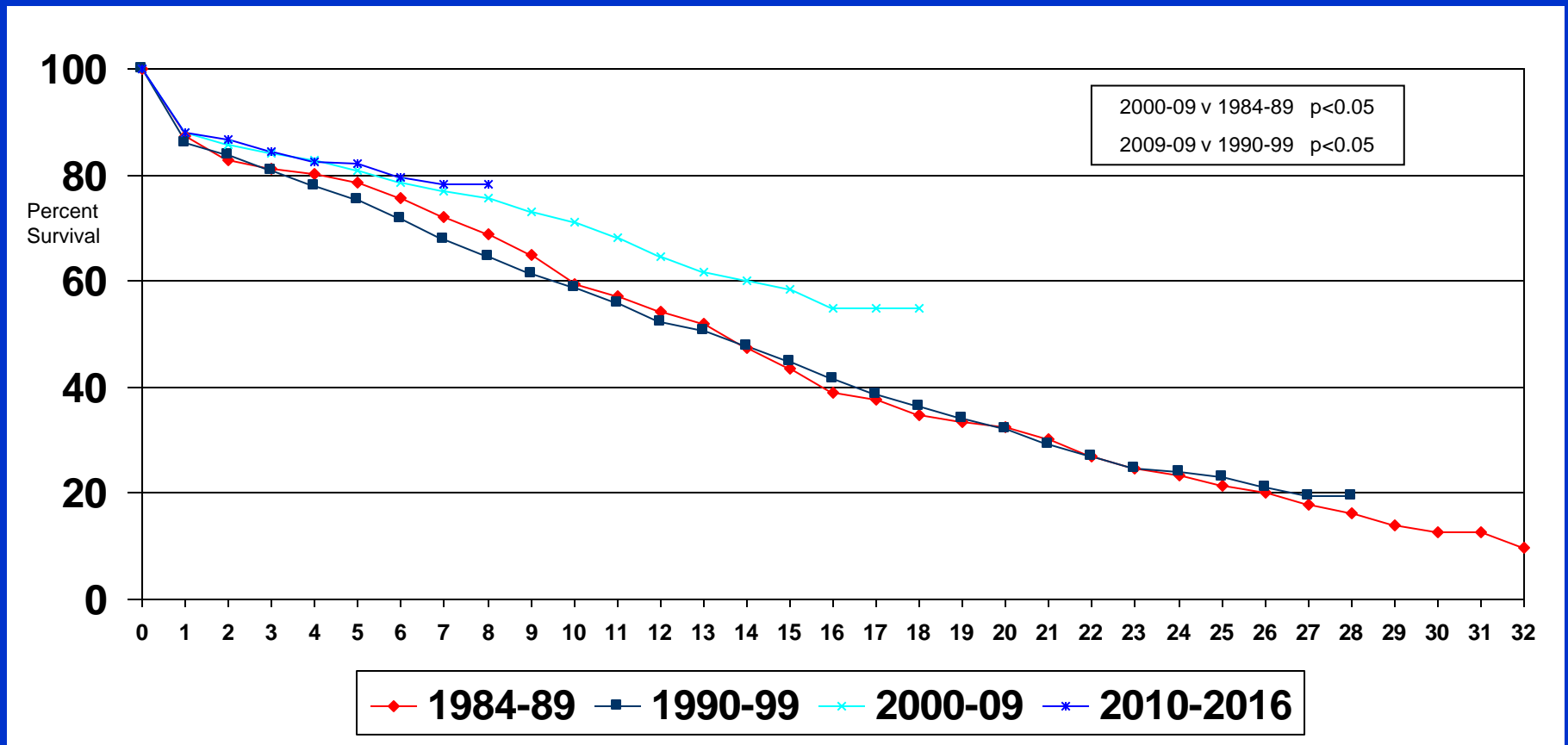
Youngest NZ transplant

- TB, weight 16kg – turned 5 on day of transplant following 3 weeks of support on Berlin Heart pump
- Donor - 47yr old female SI donor, 60kgs, Cause of death SAH
- Echo - EF 60%



Actuarial survival all hearts

Period comparison 1984 – 2016



Royal Children's recipient ages – 2015 & 2016

2015: 10 HTX – 5 \leq 5 years
5 > 14 years

2016: 15 HTX – 7 \leq 5 years
2 5-10 years
6 > 10 years

Over 2 years 12 children \leq 5 years transplanted
(serving a total population of 29 million)

Current policy

- Children whose weight is $>15\text{kg}$ will be considered for transplantation in NZ (can take small adult heart)
- Children $>15\text{-}20\text{kg}$ will be considered for LVAD support in NZ - preferred device is the Berlin Heart EXCOR
- Children $<15\text{kg}$, if requiring transplantation, will be referred to Royal Children's Melbourne
- Children $<15\text{kg}$ could be considered for EXCOR support if it is considered there is a reasonable chance of cardiac recovery
- From time to time an urgent request for a donor may be made to Australia for a suitable heart for a child or adolescent fulfilling the above criteria

All heart transplants by centre 1984 - 2016

	St Vincents	The Alfred	Perth	Auckland	Prince Charles	Royal Childrens	Year Totals
1984	14						14
1985	22						22
1986	34						34
1987	28			2			30
1988	49			5		2	56
1989	50	30		8		5	93
1990	47	38		6	8	4	103
1991	41	33		5	20	4	103
1992	36	37		11	22	9	115
1993	39	35		8	28	4	114
1994	44	25		10	21	4	104
1995	41	25	7	7	20	8	108
1996	35	24	4	13	24	3	103
1997	35	28	5	14	21	2	105
1998	26	23	9	10	10	4	82
1999	19	25	8	10	11	3	76
2000	20	22	6	13	9	0	70
2001	17	30	7	15	8	5	82
2002	19	24	6	8	17	8	82
2003	14	24	11	22	16	2	89
2004	28	23	7	4	14	2	78
2005	26	22	12	13	13	3	89
2006	19	22	7	8	16	8	80
2007	18	21	5	9	13	2	68
2008	27	28	13	8	8	6	90
2009	19	18	7	11	10	6	71
2010	27	23	6	11	3	6	76
2011	24	17	9	11	10	5	76
2012	25	15	13	12	13	7	85
2013	25	23	7	9	13	9	86
2014	28	27	3	17	12	8	95
2015	31	28	10	12	15	10	106
2016	46	21	11	11	25	15	129
Totals	973	711	173	303	400	154	2714

A Heart Donor

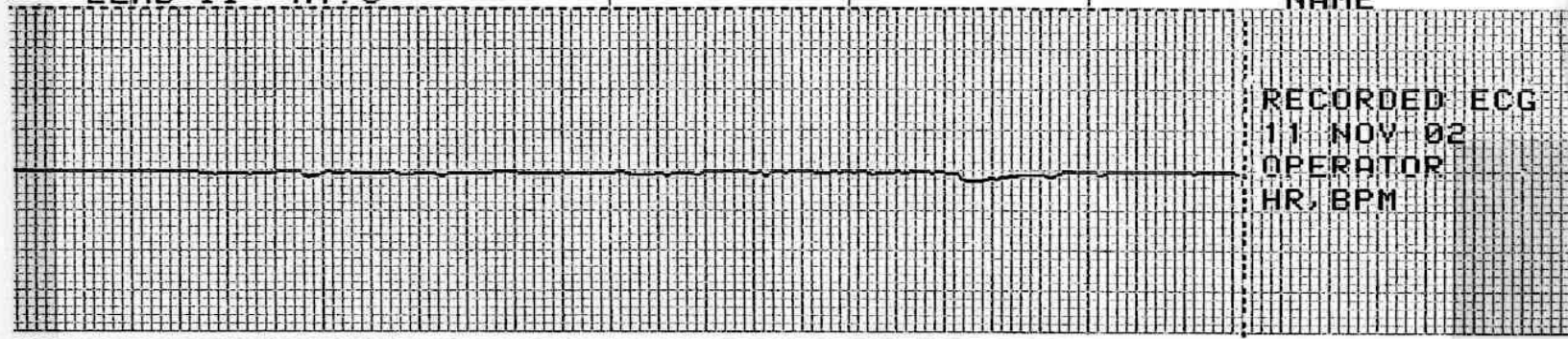
- 33 year old male
- Recreational drug user – ecstasy (MDMA), fantasy (GHB), cocaine
- No IV drugs
- No significant past medical history
- Smoker, binge drinker, lives with girlfriend
- On ACC for back pain

-
- “Out on town”
 - Returned home late “euphoric” –
unknown drugs
 - Seen at 0450
 - 0500 found arrested, CPR started
 - 0506 ambulance arrival - asystole,
no respiratory effort
 - Intermittent CPR
 - 0524 rapid AF
 - 0525 DC shock 200 J
 - 0535 sinus bradycardia
 - 0548 departed for hospital

LEAD II X1.0

NAME

RECORDED ECG
11 NOV 02
OPERATOR
HR, BPM



9-A402

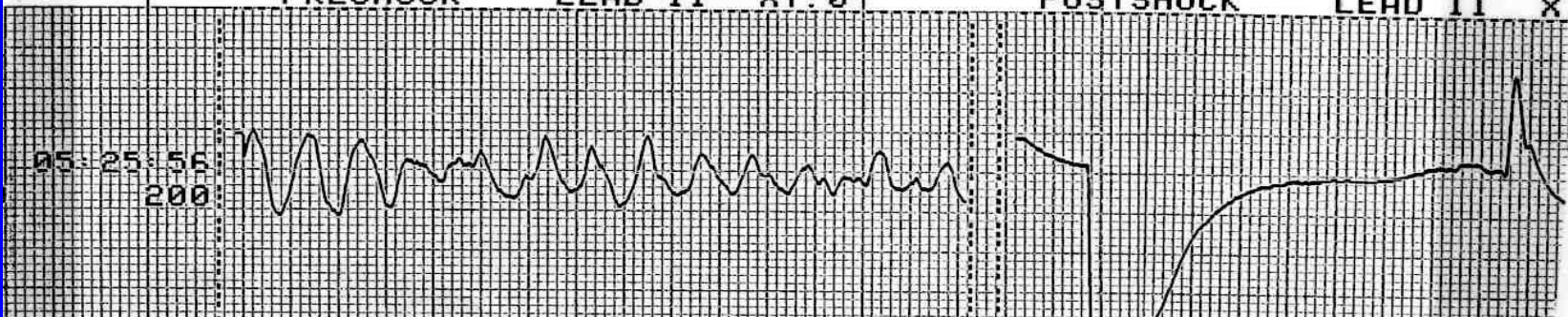
MADE IN USA

LEAD III X1.0



PRESHOCK LEAD II X1.0

POSTSHOCK LEAD II X



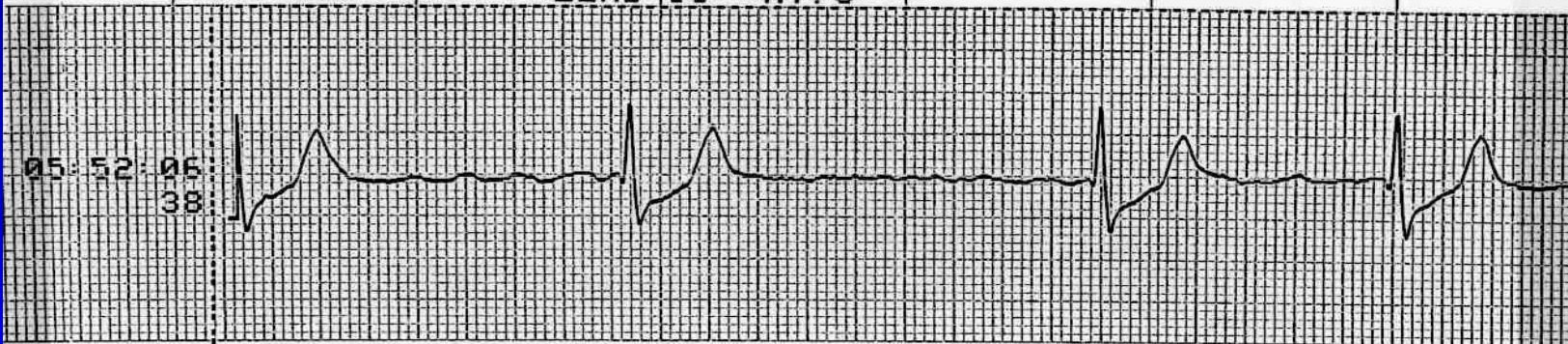
LEAD II X110

05:40:41
127



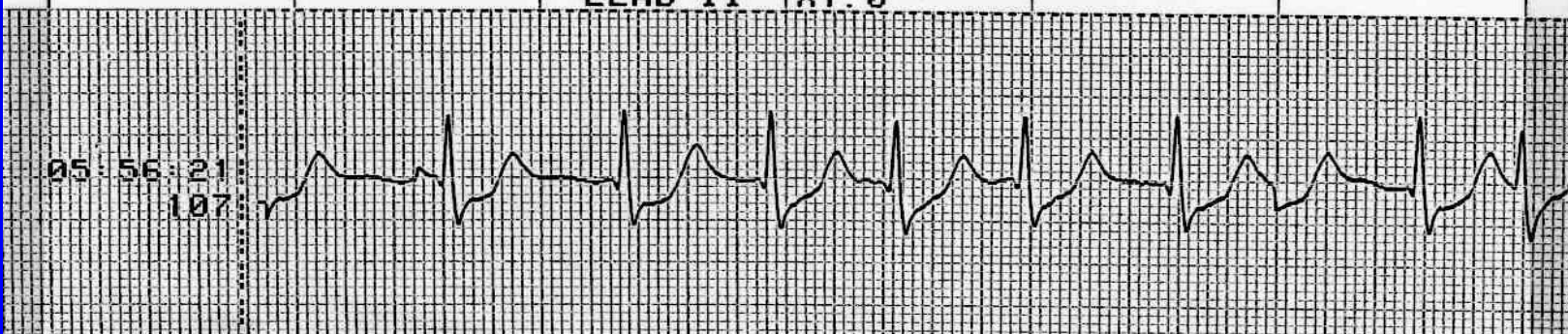
LEAD II X1.0

05:52:06
38



LEAD II X1.0

05:56:21
107



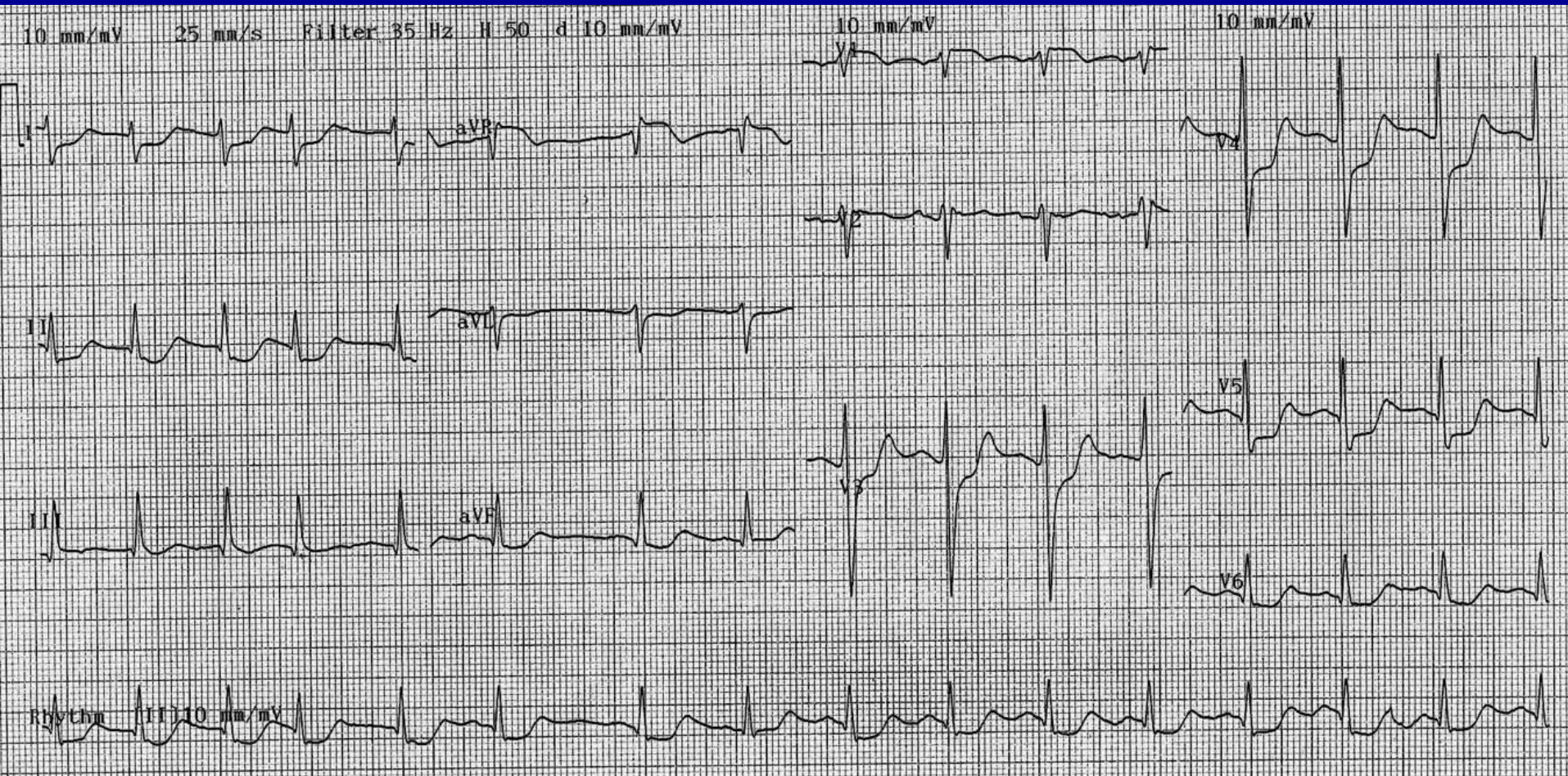
Resuscitation medication

- **Naloxone 0.4mg**
- **Adrenalin 1mg x 4**
- **Atropine 3mg**
- **NaCl - 2 litres**

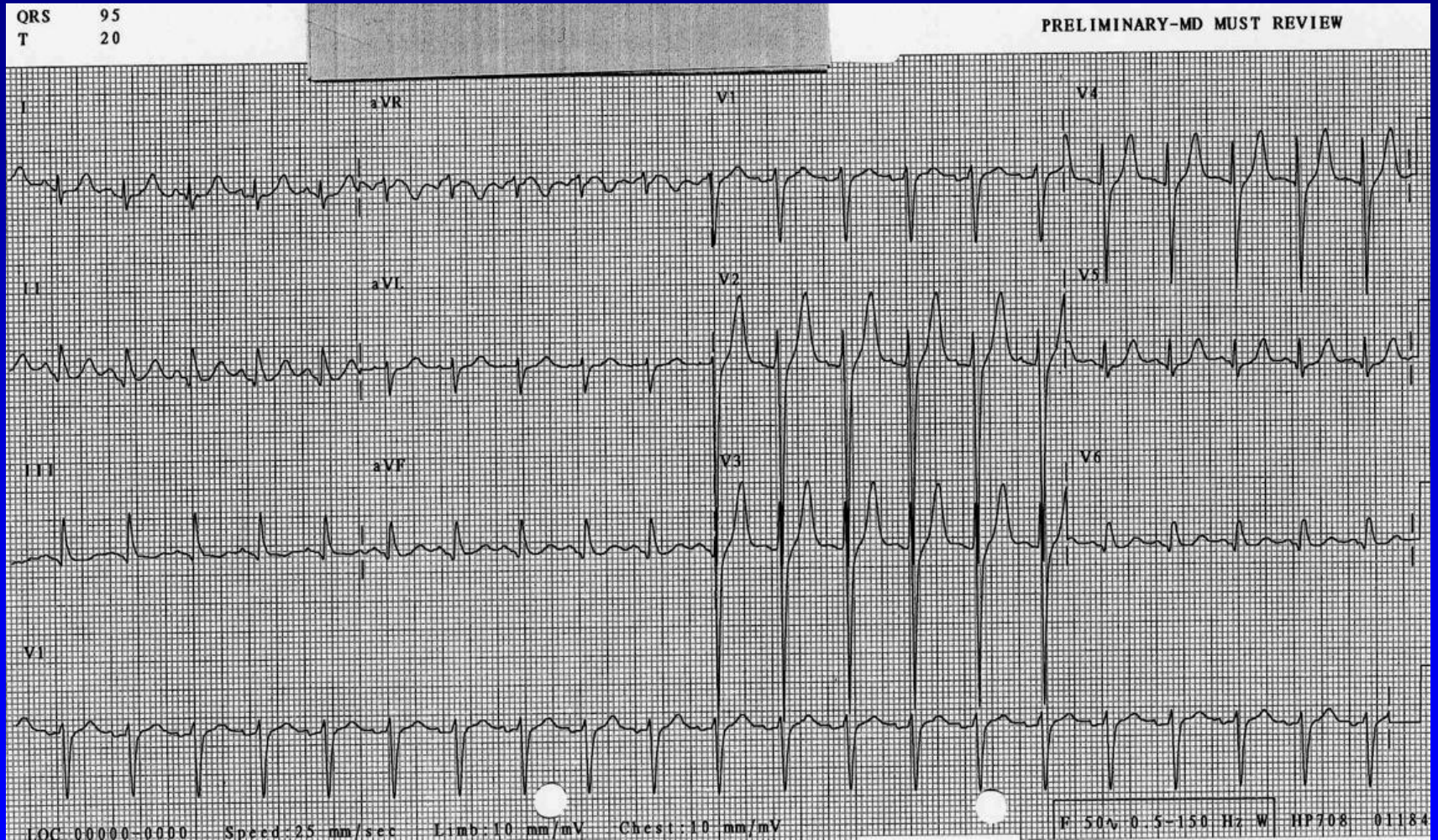
Arrived hospital 0554

- Intubated, pupils fixed and dilated
- Hypothermic, mixed respiratory/metabolic acidosis
- CXR - ARDS picture
- Dopamine (10mcg/kg/min) & NA (0.03mcg/kg/min) infusions
- Urine – positive for amphetamine & cocaine
- Brain death tests performed

0608 -Sinus rhythm with atrial ectopics ST depression leads I, II, aVF, V3-V6



0943 - Sinus tachycardia within normal limits



Recipient

- **25 year-old male**
- **End-stage cardiomyopathy**
- **Inotrope dependent - dobutamine**
- **In hospital approximately 5 months**
- **Ischaemic time 273 minutes**
- **Discharged day 22 post transplant with normal cardiac function**

- **Now 9 years post – alive and well**
- **Works as a mechanic, has a 5 year old son**
- **Echo – Normal LV size and function**

Conclusions

- **Acceptance of a donor heart following cardiac arrest can be associated with a good recipient outcome provided (near) normal echocardiographic function**
- **Most brain dead patients aged < 60 years should be considered a potential heart donor regardless of circumstances surrounding death**
- **Outcomes following transplantation do not appear to have been adversely influenced by a more liberal acceptance policy**

NZ Paediatric transplants 2013-2017

	Initials	Age at HTX	Date of HTX		
Ctx257	BP	9	18.05.13	N	
Ctx259	GW	16	26.07.13	M	† 14.07.15
Ctx280	NK	9	15.12.14	N	
Ctx286	TB	5	02.08.15	N	
Ctx290	AN	7	16.11.15	N	
Ctx293	BW	16	09.02.16	M	† 14.02.16
Ctx304	LC	13	21.01.17	M	
Ctx307	SS	11	22.03.17	N	
Ctx310	KP	11	10.05.17	N	
Ctx 319	CP	8	19.9.17	N	
	LL	2	23.01.16	Melb	
	IH	1	24.09.16	Toronto	

	Pre Nipride	Nipride 75mcg/min	23/11/16	13/9/17
RA	12	7	10	9
Arterial	108/63 77	81/46 58		
PA	88/34 55	55/19 32	79/36 49	77/32 46
Wedge	32	17	32	28
TPG	23	15	17	18
Sat PA	60%	70.5%	67%	67%
QP	3.2	4.26	3.7	3.9
PVR	7.2 Wood Units	3.5	4.6	4.6

Waiting days to heart transplant 1984-2016

year	n	mean	std dev + -	median	min-max
1984	14	44	77	10	4-295
1985	19	46	54	19	3-209
1986	32	67	76	37	3-295
1987	30	61	80	40	3-424
1988	56	80	102	33	1-400
1989	93	86	87	61	1-445
1990	103	99	154	35	1-842
1991	103	103	126	57	1-633
1992	115	87	119	51	1-790
1993	114	116	127	78	1-626
1994	104	192	219	128	1-999*
1995	108	203	236	107	3-999*
1996	103	171	200	92	2-999*
1997	105	228	265	127	1-999*
1998	82	185	219	117	1-999*
1999	75	236	260	133	1-999*
2000	70	196	227	120	1-999*
2001	80	177	212	88	1-999*
2002	82	148	219	64	1-999*
2003	88	143	162	91	1-782
2004	76	134	176	67	1-908
2005	89	159	169	113	2-792
2006	79	150	155	102	2-764
2007	63	163	180	125	1-974
2008	89	171	174	127	1-976
2009	68	147	132	103	5-565
2010	74	180	232	97	0-999*
2011	76	171	165	115	1-586
2012	84	202	213	139	2-1181
2013	84	225	298	102	0-1668
2014	95	197	279	96	0-1638
2015	102	194	203	123	0-1027
2016	124	156	219	68	0-1268

Donor age hearts 1984-2016

year	n	mean	std dev +-	median	min-max
1984	14	24	8	23	13-41
1985	19	24	7	21	15-43
1986	32	26	7	25	16-39
1987	30	25	7	24	14-41
1988	56	25	8	23	12-44
1989	93	28	11	26	1-50
1990	103	30	11	28	9-52
1991	103	30	12	28	5-58
1992	115	30	12	28	1-56
1993	114	34	13	32	8-61
1994	104	34	14	31	1-66
1995	108	32	14	33	2-59
1996	103	33	12	33	1-57
1997	105	35	13	35	12-58
1998	82	31	13	30	1-62
1999	75	34	16	32	1-64
2000	70	33	13	33	5-57
2001	80	33	14	33	6-58
2002	82	30	15	25	2-60
2003	88	35	14	36	8-62
2004	76	33	14	31	7-59
2005	89	37	14	39	9-61
2006	79	31	14	29	5-59
2007	66	34	15	35	10-59
2008	89	37	13	40	2-61
2009	68	33	14	34	5-62
2010	74	38	12	39	6-60
2011	76	34	14	33	5-58
2012	84	34	14	34	4-58
2013	84	33	15	34	1-57
2014	95	36	14	37	1-60
2015	102	35	13	35	2-59
2016	124	33	15	32	1-61