

# Liver Transplantation

## Australian National Liver Transplantation Unit

**Data to 31 December 2013**



The Australian National Liver Transplantation Unit, Royal Prince Alfred Hospital, Sydney, Australia  
is a combined facility of  
Sydney Local Health District,  
The University of Sydney  
and  
The Children's Hospital at Westmead

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# Preface

In 2013, 74 new and 6 secondary orthotopic liver transplant procedures were performed within the ANLTU (14 – The Children’s Hospital at Westmead; 66 – Royal Prince Alfred Hospital). This included the ongoing usage of split liver allograft and the use of extended criteria donor liver allograft, which maximise the limited donor resources available.

The staff within the ANLTU would like to thank the members of the departments within Royal Prince Alfred Hospital and Sydney Local Health Network who have helped contribute to the success of the program in the past year. This includes Haematology, Biochemistry, other Laboratory services, Blood Bank, Department of Pathology, Department of Renal Medicine, Intensive Care Unit, Operating Room, Department of Psychiatry, Department of Cardiology, Department of Respiratory Medicine, Dietetic Department, Department of Social work, Department of Anaesthesia, the Casemix unit and all the other people who have not been specifically mentioned.

We would also like to thank the other departments within the Children’s Hospital at Westmead, who have helped contribute to the success of the paediatric programme. These include the membership of Department of Anaesthesia, the Intensive Care Unit, Laboratory services staff, Department of Social Work, Department of Nutrition and other medical departments.

The staff of the Australian Red Cross Blood Service are also acknowledged for their assistance during the year.

Finally, without the generosity of the deceased organ donors and their families, liver transplantation would not be able to proceed at this level. Hence we give our thanks to them as well as to the team at Donate Life NSW, Kogarah.

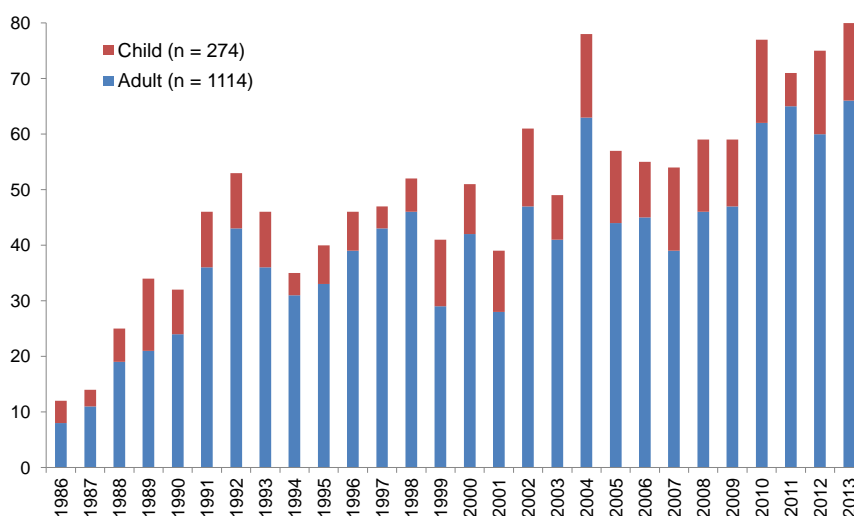
Professor Geoff McCaughan  
Dr Deborah Verran  
Dr Michael Crawford  
Pamela Dilworth  
Gavin Lackey  
Bessie Berberovic

# Summary

There are several key issues to report.

1. From January 1986 to December 2013, 1388 liver transplants were performed on 1278 patients, of which 1043 and 235 recipients were adults and children, respectively.
2. The number of transplants per year continues to be related to the deceased donor rate.
3. In 2013, 31 patients (19%) on the waiting list were subsequently withdrawn due to advanced and/or extra-hepatic disease. Three (2%) patients improved whilst on the waiting list. During this period, there were 80 liver transplantation operative procedures of which 74 patients received primary grafts.
4. The movement of patients on and off the waiting list continues to be dynamic.
5. The average waiting time for adults in all blood groups remains variable depending on blood group.
6. The median deceased donor age has increased from 29 years (1986 – 1994) to 44 years (2005 to 2013). There is a decreased number of Donation after Cardiac Death donor liver offers – 17 offers in 2013, of which three were used.
7. The median age for adult recipients has increased from 45.4 years (1986 – 1994) to now stand at 51.2 years. The median age for child recipients has decreased from 4.4 years (1986 – 1994) and now stands at 2.0 years.
8. HCV infection has been an increasing indication for liver transplantation in adults. In the period 1986 – 1994 9% of adults had this diagnosis compared to 39% in 2005 – 2013. In 2013, 46% of adults transplanted had Chronic HCV.
9. Hepatocellular carcinoma has also become an increasingly common indication for liver transplantation, with 35% of the adult recipients having a diagnosis of HCC in the five year period 2009 – 2013.
10. The overall patient survival rate over the past 2 years was 96% at one year.

## Australian National Liver Transplant Unit

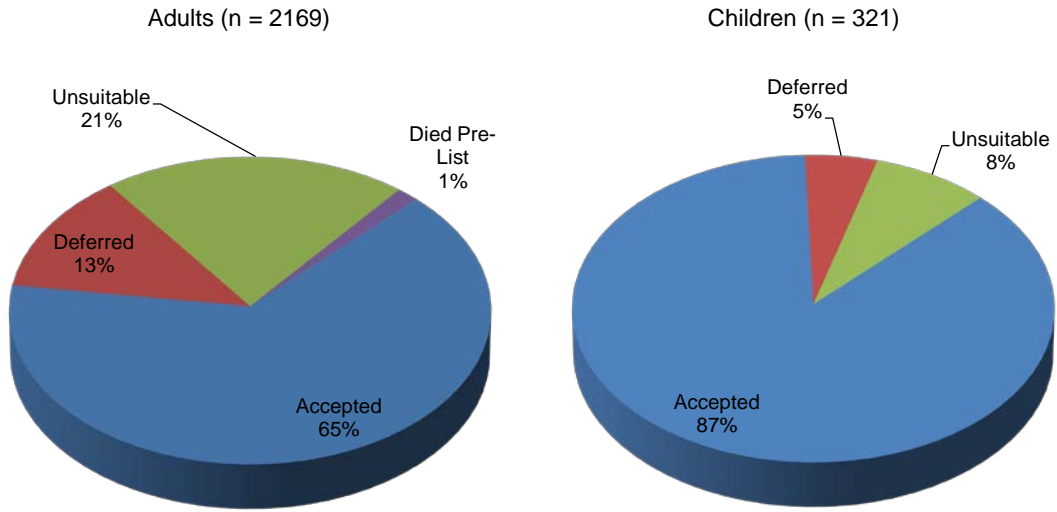




# ASSESSMENT INFORMATION

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## Allocation of Patients Accepted for Assessment



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## Patients Considered Unsuitable for Transplantation

2169 Adults have been assessed since 1985

Reason	Adults	
Too Advanced + extra-hepatic disease	165	36%
Tumour Progression + Tumour (extra-hepatic spread)	74	16%
Good prognosis	65	14%
Psychological	59	13%
Alcohol	56	12%
Patient's (Parent's) wish	24	5%
Alternative therapy	7	2%
Age	5	1%
Logistics	1	0.2%
<b>Total</b>	<b>456</b>	

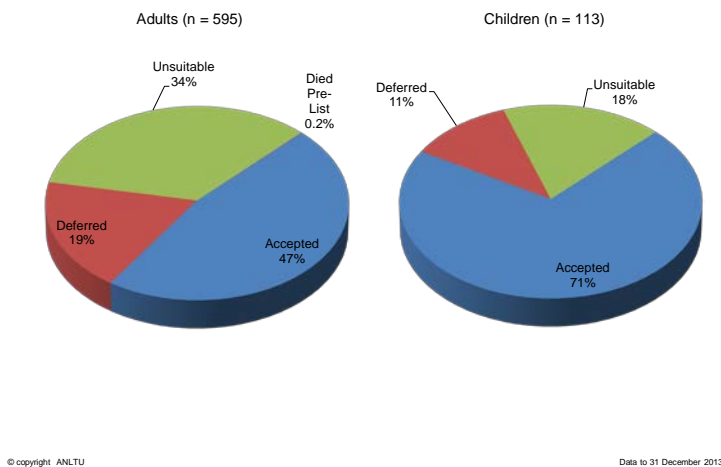
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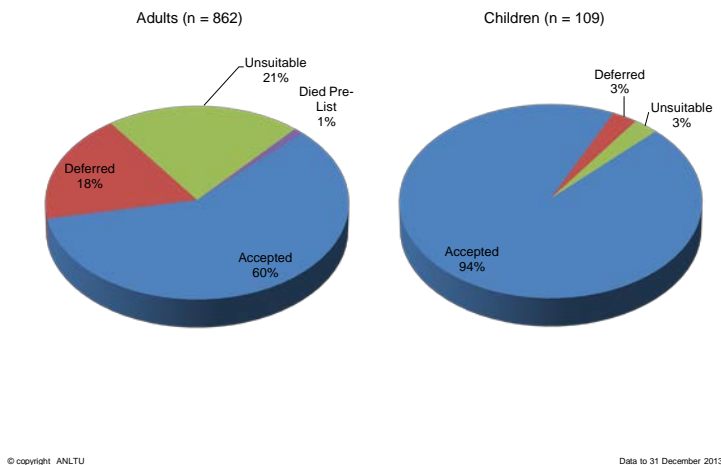


## Comparison Over Time of Patients Assessed

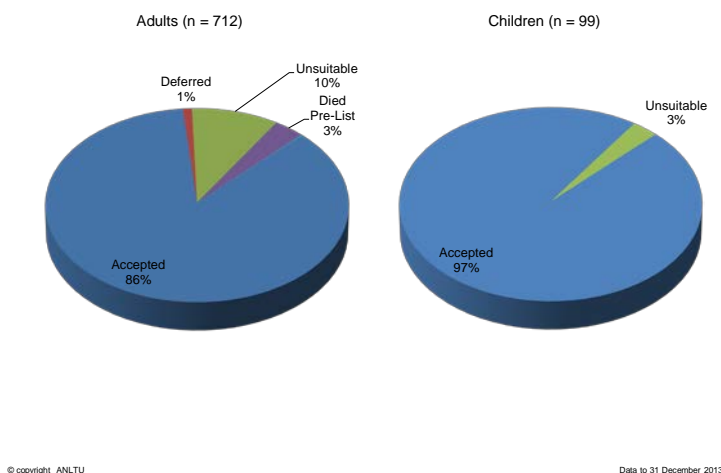
### 1985 - 1994



### 1995 - 2004



### 2005 - 2013



Adult patient acceptance rate has increased from 47% in the period of 1985 – 1994 to 86% in 2005 – 2013.

Child patient acceptance rate has increased from 71% in the period of 1985 – 1994 to 97% in 2005 – 2013.

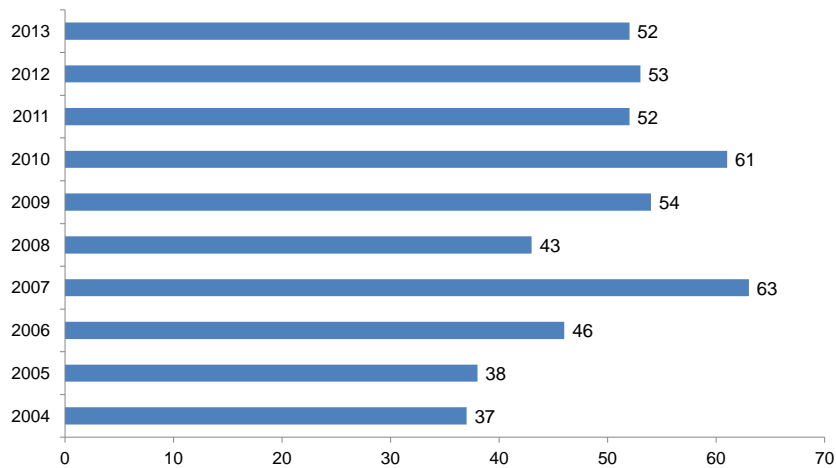
## Waiting List Activity

Year		Listed at Start of Year	New Listings	Total	Tx	Died Pre Tx	Withdrawn		Total Withdrawn /Mortality	Improved	Listed at End of Year
							Tumour Progressed	Other			
2004	n	31	101	130	78	7	0	2	12	3	37
	%				60	5.4	0	1.5	9	2.3	
2005	n	37	83	120	54	10	1	6	17	3	38
	%				45	8.3	0.8	5	14	2.5	
2006	n	38	83	121	55	6	3	0	9	6	46
	%				45	5	2.5	0	7.4	5	
2007	n	46	95	141	54	19	2	2	23	2	63
	%				38	13	1	1	16	1	
2008	n	63	76	139	59	25	2	5	32	5	43
	%				42	18	1	3.5	23	3.5	
2009	n	43	97	140	59	11	3	5	19	8	54
	%				42	8	2	3.5	13.6	5.7	
2010	n	54	98	152	77	6	4	2	12	2	61
	%				51	4	3	1	8	1	
2011	n	61	82	143	71	9	5	2	16	4	52
	%				50	6	3	1	11	3	
2012	n	52	104	156	75	15	2	9	26	2	53
	%				48	10	1.3	6	17	1.3	
2013	n	53	113	166	80	15	5	11	31	3	52
	%				48	9	3	7	19	2	

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## Patients on Waiting List at the end of Calendar Year



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## % Patients Withdrawn from Waiting List



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## Urgent Listings 2013

Number of Patients Listed as Urgent	Cat 1	Cat 2	Total
Transplanted	3	5	<b>8</b>
Died on Waiting List	1	1	<b>2</b>
Delisted	0	0	<b>0</b>
Improved – withdrawn	1	0	<b>1</b>
<b>Total</b>	<b>5</b>	<b>6</b>	<b>11</b>

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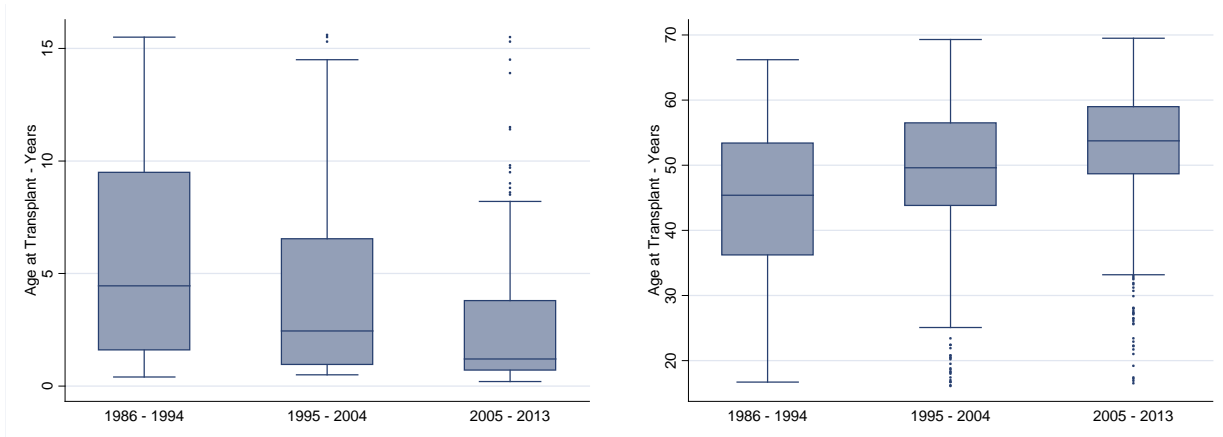
## Age of Transplant Recipients (Primary Grafts)

### Children

n 235  
 Median 2.0 years  
 Mean 4.2 years  
 Range 0.2 – 15.6 years

### Adults

n 1034  
 Median 51.2 years  
 Mean 49.0 years  
 Range 16.1 – 69.5 years



	1986 - 1994	1995 - 2004	2005 - 2013
n	56	84	95
Median	4.4	2.5	1.2
Mean	5.7	4.3	3.1

	1986 - 1994	1995 - 2004	2005 - 2013
n	218	381	444
Median	45.4	49.6	53.8
Mean	43.8	48.5	51.9

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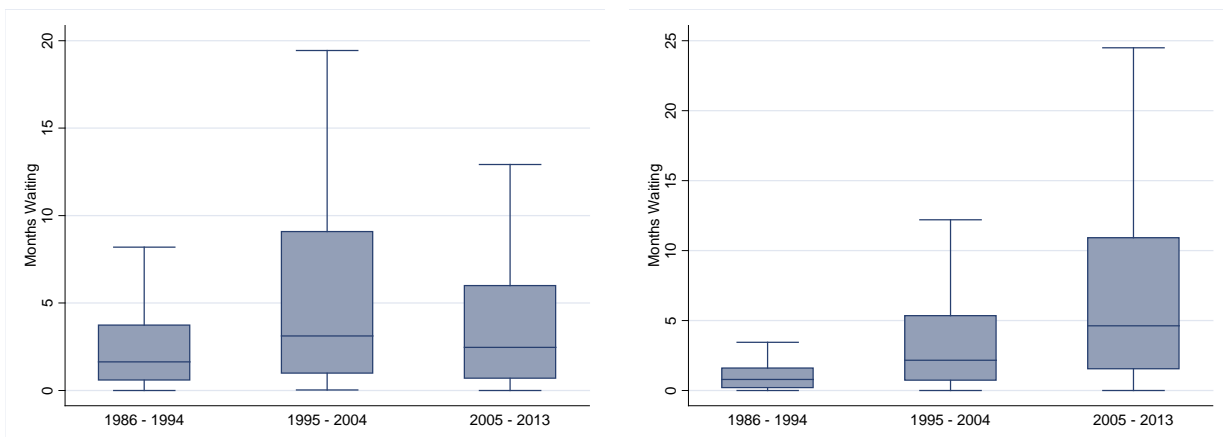
## Waiting Time of Transplant Recipients (Primary Grafts)

### Children

Median 2.41 months  
 Mean 5.36 months  
 Max 48.10 months

### Adults

Median 2.33 months  
 Mean 5.32 months  
 Max 95.48 months



	1986 - 1994	1995 - 2004	2005 - 2013
Median	1.64	3.11	2.46
Mean	2.95	6.67	5.52
Max	14.49	48.10	76.49

	1986 - 1994	1995 - 2004	2005 - 2013
Median	0.79	2.16	4.62
Mean	1.27	4.39	8.11
Max	7.80	69.25	95.48

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## Adult Mean Days Waiting Primary Liver Transplantation vs ABO (2006 – 2013)



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## Adult Mean Days Waiting Primary Liver Transplantation vs ABO (2006 – 2013)

	2006 – 2008	2009 – 2011	2012 - 2013	Overall
<b>A</b>	173	269	293	250
<b>AB</b>	95	55	118	81
<b>B</b>	289	423	309	339
<b>O</b>	349	239	202	263
<b>Mean</b>	258	265	255	260

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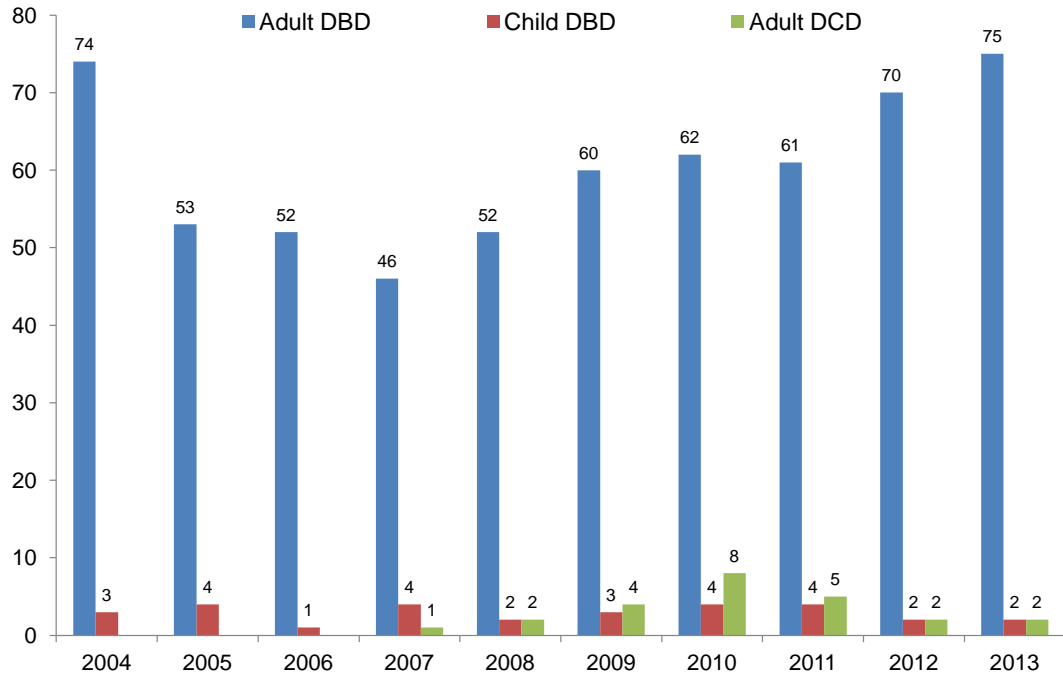
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# DONOR INFORMATION

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## (Deceased) Adult vs Paediatric Donors by Year



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Since 2000, 91% of liver donors were adults (>=16yrs) and 9% were paediatric donors.

## Deceased Donor Offers to NSW 2006 - 2013

Donor Type	State	2006 – 2008	2009 – 2011	2012	2013	Total
DBD	ACT	9	18	9	5	41
	NSW	139	177	71	88	475
	NT	3	2	1	1	7
	NZ	13	10	3	1	27
	QLD	20	17	5	5	47
	SA	17	12	2	7	38
	TAS	6	1		1	8
	VIC	23	22	11	7	63
	WA	9	13	5	6	33
Total BDD Offers		239	272	107	121	739
BDD Used		137	170	64	68	439
DCD	ACT	3	8	1		12
	NSW	19	65	23	15	122
	QLD	0	0		1	1
	VIC	0	8		1	9
	SA/WA	0	0	2		2
Total DCD Offers		22	81	26	17	146
DCD Used		3	17	2	3	25
Total Offers		261	357	133	138	889
Total Used		140	187	66	71	464

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## DBD Donor Offers Declined 2013 53/121 (47.9%)

	Declined at Offer	Declined at Hepatectomy
Abnormal LFT's	4	
Cirrhosis		6
Donor age	1	
Donor history *	9	
Donor malignancy - extrahepatic		1
Fibrosis		2
High risk donor for tumour or infection	4	
Logistics**	1	
No suitable recipient	5	
Offer waived for urgent Tx elsewhere	3	
Perfusion failure		1
Positive virology	1	
Steatosis		8
Trauma to liver		2
Unstable		1
Vascular issues		1
Other ***		3
<b>TOTAL</b>	<b>28</b>	<b>25</b>

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## DBD Donor Offers Declined 2013 53/121 (47.9%)

- \* Donor history
  - 1 HCV, IVDU, heavy alcohol and metho, track marks, multiple paracetamol OD's, abnormal LFT's.
  - 2 Medically unsuitable - long hospital stay, multiple infections, medical hx (cardiac, ARF, diabetes).
  - 3 Marginal donor - age, history. Would need to send team to Mackay to retrieve
  - 4 HCV, found needle in arm
  - 5 Marginal donor. interstate team unable to retrieve at late notice. Deemed not appropriate to send our team interstate. BMI 36, age, extensive cardiac hx, diabetes, alcohol intake
  - 6 Age and heavy drinker. Note already accepted a local donor
  - 7 Age, obesity, comorbidities
  - 8 Abnormal LFTs, high risk for virus, uncertain cause of death, expected long ischaemic time
  - 9 Long down time- approx 1.5 hours. Abnormal LFTs and blood gas
  
- \*\* Logistics
  - 1 Abandoned. Donor 4 of 5. Donor family unable to delay. Accepted by VIC
  
- \*\*\* Other
  - 1 Compartment syndrome. Liver mottled & mushy
  - 2 Accepted R lobe but did not proceed to split. L lateral too big for intended paed pt. They kept whole graft for another pt.
  - 3 Was offered R) lobe. Was unable to split due to paediatric vessel requirements. Liver sent as whole graft to urgent in Victoria.

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## DCD Donor Offers Declined 2013 14/17 (82.4%)

	Declined at Offer	Declined at Hepatectomy
Did not proceed to hepatectomy		5
Donor age	1	
Donor history *	1	
Donor obesity	2	
High risk donor for tumour or infection		1
Impaired perfusion/ischaemia		1
Outside DCD acceptance criteria	1	
Other **	2	
<b>TOTAL</b>	<b>7</b>	<b>7</b>

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## DCD Donor Offers Declined 2013 14/17 (82.4%)

- \* Donor history      1      Obesity, heavy ETOH, abnormal LFTs
- \*\* Other              1      No size appropriate recipient who is ABO compatible. Declined all units. Kidney only donor
- 2      DCD offer accepted from Vic for morning retrieval. The became BD overnight. They offered to rotation and was accepted by another state

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## Enquiries Declined 2013

	Declined at Enquiry
Abnormal LFTs	1
Consent withdrawn/relatives refused consent	7
Donor age	2
Donor history	5
Donor obesity	1
High risk donor for tumour or infection	10
Interstate donor not suitable for directed recipient (Urgent Case)	4
Logistics	1
No suitable ABO compatible recipient	3
No suitable recipient	3
Outside DCD acceptance criteria	1
Unstable	2
Other **	3
<b>TOTAL</b>	<b>43</b>

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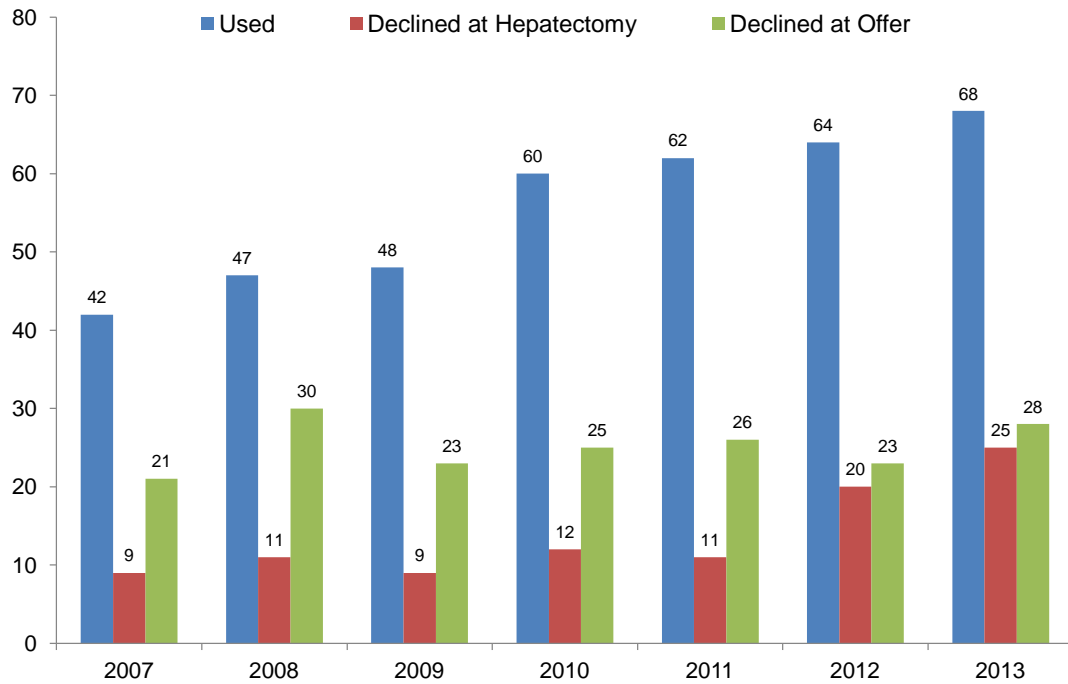
## Enquiries Declined 2013

*	Donor history	1	Age, BMI 32, downtime, hx HT, diabetes, high cholesterol, CRF, IHD, AMI, LFTs slightly raised, subdural haematoma
		2	Age, comorbidities
		3	ETOH liver cirrhosis
		4	Morbidly obese (BMI 39), longstanding HT and hypercholesterolaemia, heavy smoker and drinker
		5	Polycythaemia, HT, AF
**	Outside DCD acceptance criteria	1	Offered from Victoria for Cat 2A urgent
***	Other	1	Did not proceed to formal offer. Withdrew treatment. Iliac veins thrombosed
		2	Did not proceed to formal offer
		3	Not medically suitable - genetic hypertriglyceridemia, SIRS, compartments, high LFT's, rhabdo

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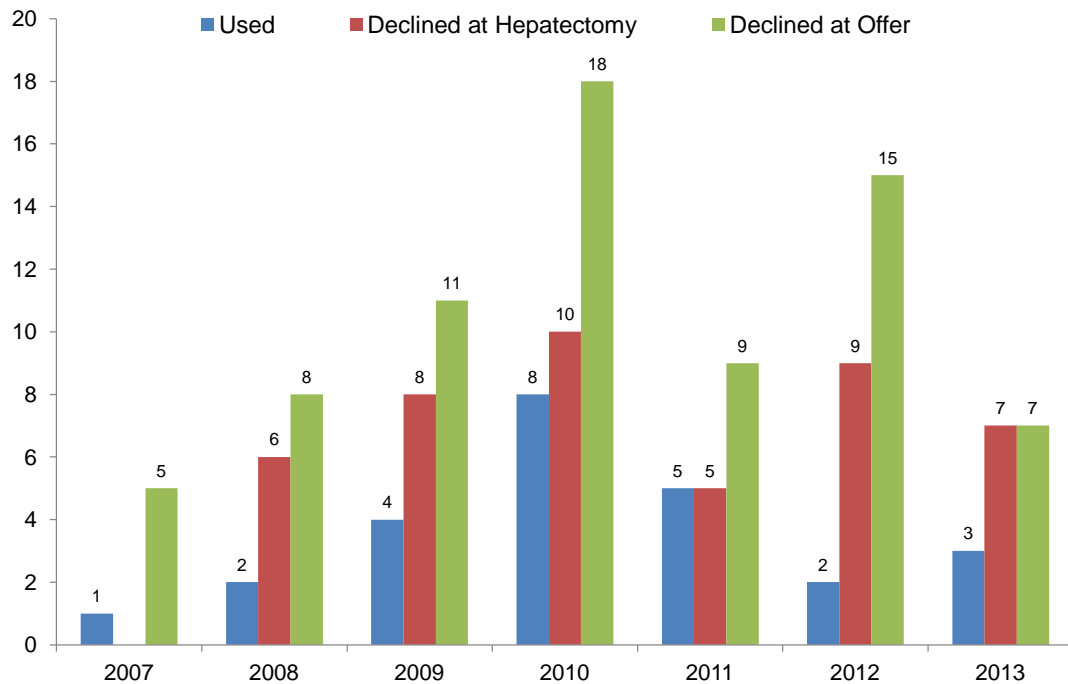
## DBD Donor Offers to NSW



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## DCD Donor Offers to NSW



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## Allocation of Accepted and Utilised Deceased Donor Livers

1st Recipient Allocation		Total
DBD	Highest prioritised patient suitable for this type of graft	42
	Higher priority patient(s) refused offer or unavailable or uncontactable	1
	Higher priority patient(s) have HCV and older donor	2
	Higher priority patient(s) medically unfit	3
	No prioritised patient in this ABO suitable	3
	Size of graft not suitable for higher priority patient(s)	16
	Other *	1
DCD	Highest prioritised patient suitable for this type of graft	3
<b>Total</b>		<b>71</b>

2nd Recipient Allocation		Total
DBD	Highest prioritised patient suitable for this type of graft	8
<b>Total</b>		<b>8</b>

\* Other Required combined lung/liver tx – allocated lungs by SVH team

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## Living Donor Procedures – Paediatric vs Adult

Year	1990	2002	2003	2004	2006	2007	2008	2009	2010	2011	2012	2013	Total
Type	LRD	LRD	LUD *	LRD	LRD	LRD	LRD	LRD	LRD	LUD **	LRD	LUD *	
Total	1	1	1	1	2	3	3	2	3	1	2	1	21

\* The Living Unrelated Donor Procedures in 2003 and 2013 were adult domino transplants.

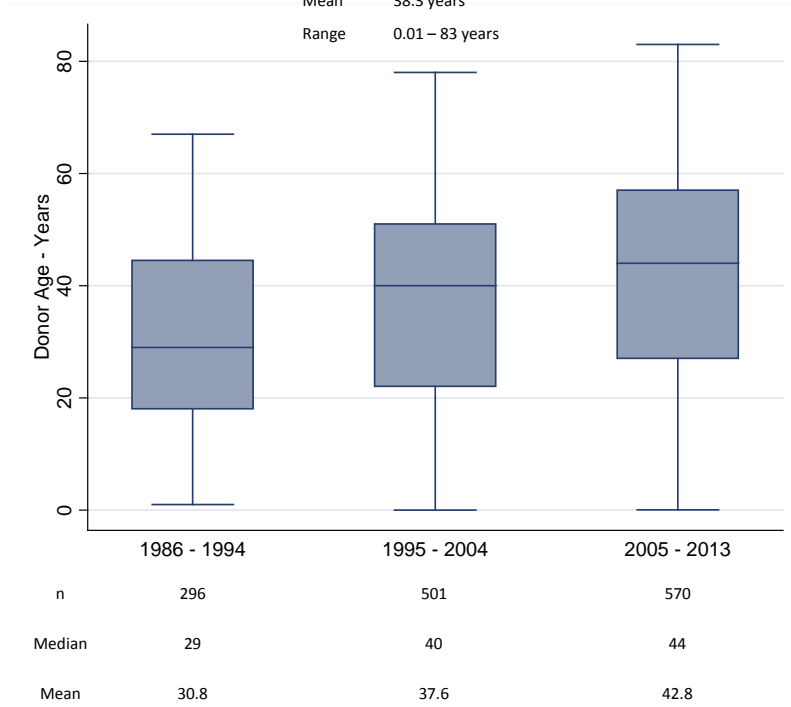
\*\* The Living Unrelated Donor Procedure in 2011 was Husband to Wife.

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## Deceased Donor Age by Era

n = 1367  
 Median 40 years  
 Mean 38.3 years  
 Range 0.01 – 83 years

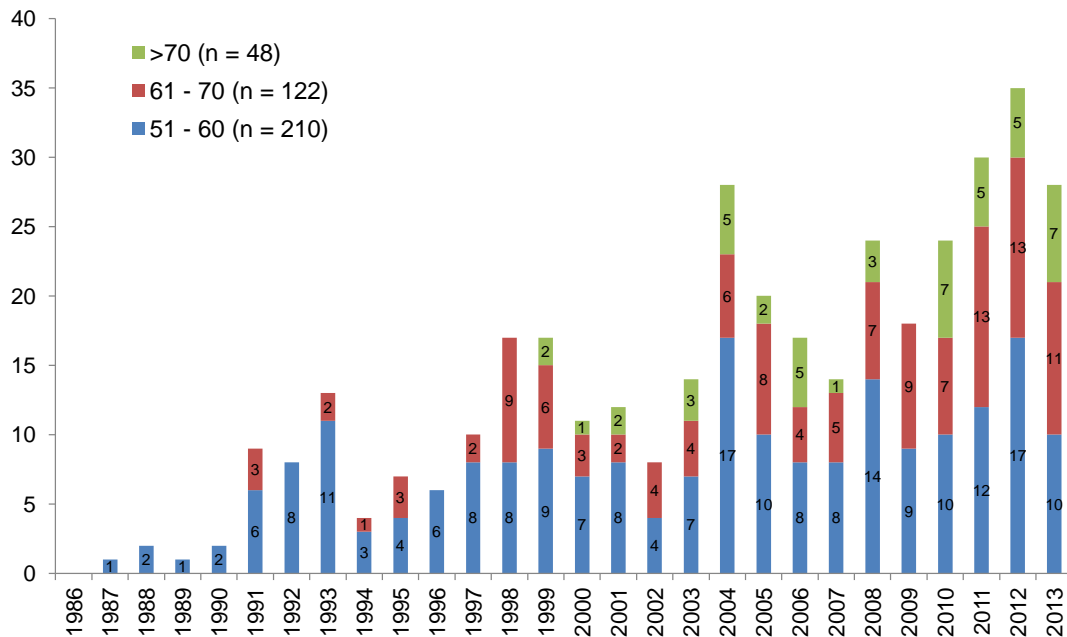


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The donor age ranged from 0 to 84 years, with a mean value of 38.3 years.

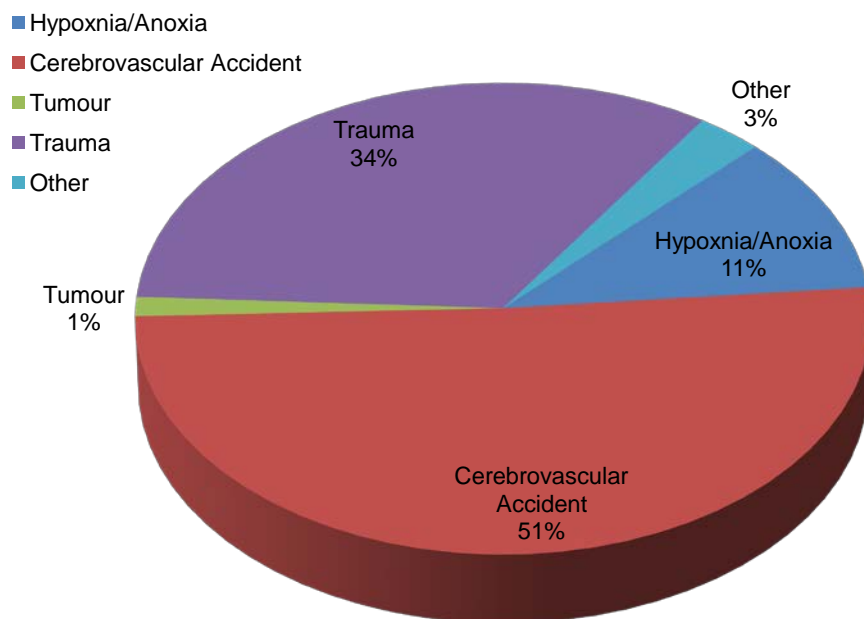
## Deceased Donors Over 50 Years (n = 380)



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## Deceased Donor Cause of Death (n = 1367)

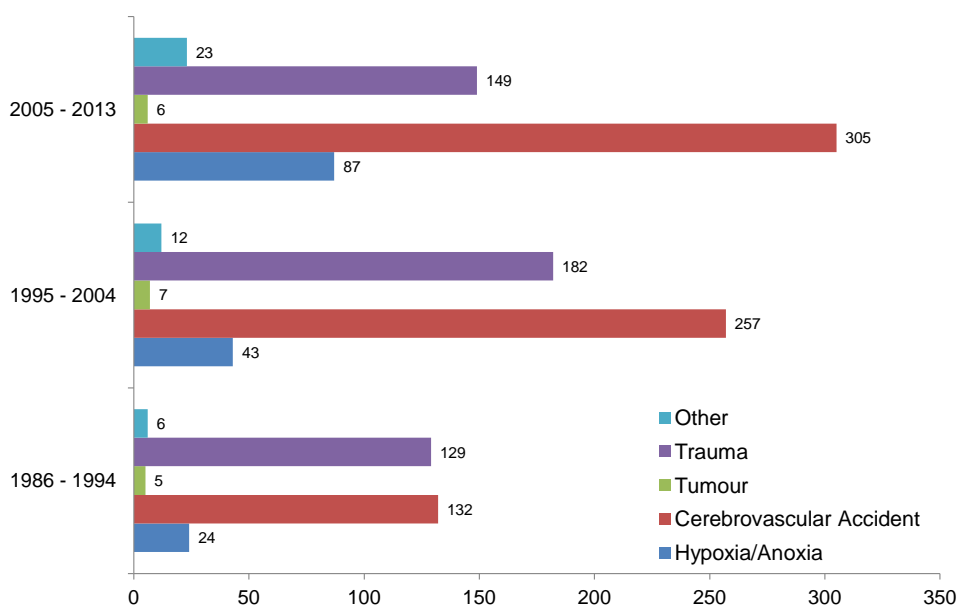


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694 (51%) donors died due to cerebral haemorrhage, 460 (34%) died due to trauma.

## Deceased Donor Cause of Death by Era

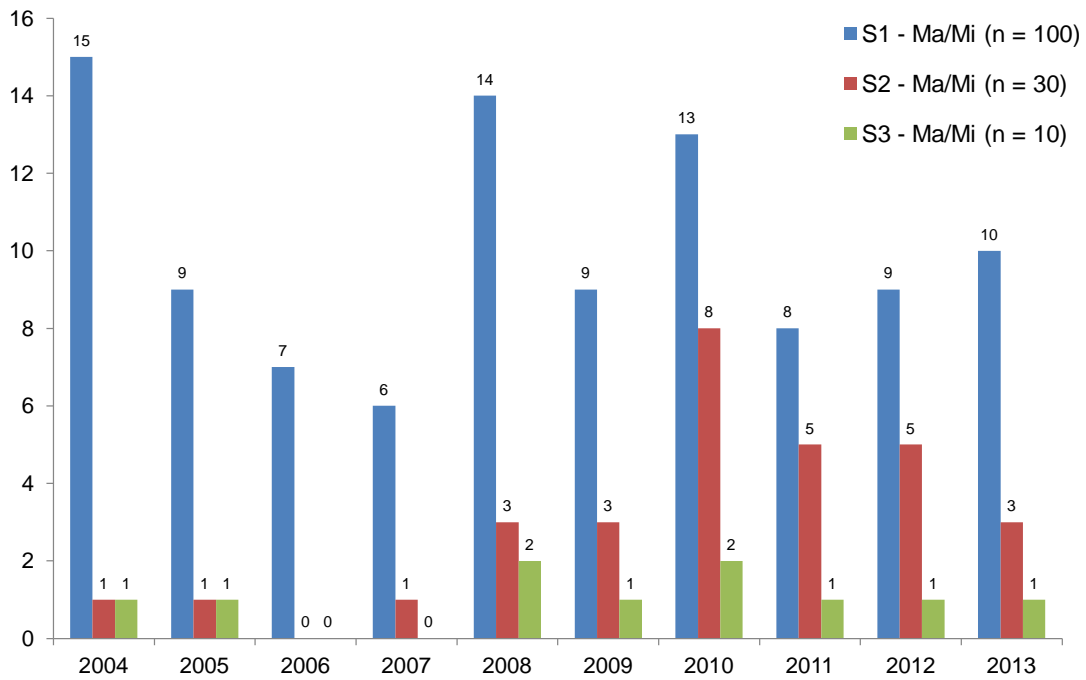


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Deaths due to trauma were 44% (1986 – 1994), 36% (1995 – 2004) and 26% (2005 – 2013). In these same time periods, deaths due to cerebral causes were 45%, 51% and 54%.

## Adult Graft Steatosis 2004 - 2013



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### Steatosis Scoring:

S0 less than 5% steatosis in biopsy (either macro or micro)

S1 Ma/Mi 5 – 29% Macrovesicular steatosis on biopsy combined with varying degrees of Micro

S2 Ma/Mi 30 < 60% Macrovesicular steatosis on biopsy combined with varying degrees of Micro

S3 Ma/Mi 60 +% Macrovesicular steatosis on biopsy combined with varying degrees of Micro

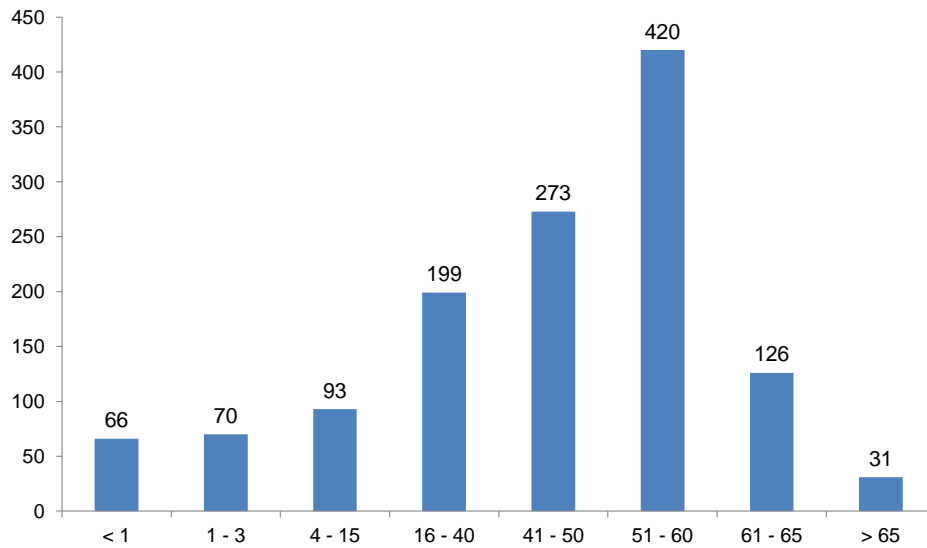
There are 56 cases (8.6%) where post reperfusion biopsy was not performed.



# RECIPIENT DEMOGRAPHICS

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### Breakdown of Patient Age at Primary Transplant (n = 1278)

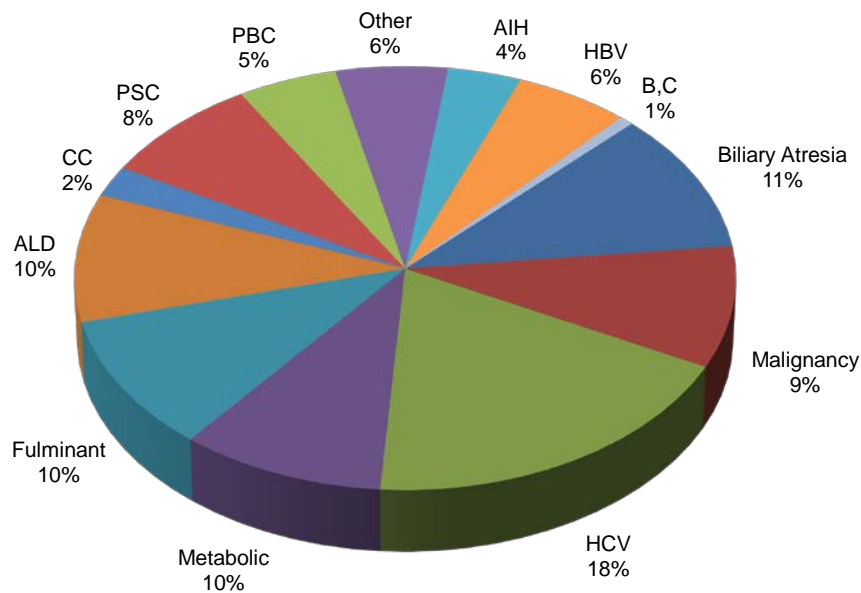


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The modal group was in the age range 51 – 60 years (32.9%).

### Primary Disease – All Patients (n = 1278)

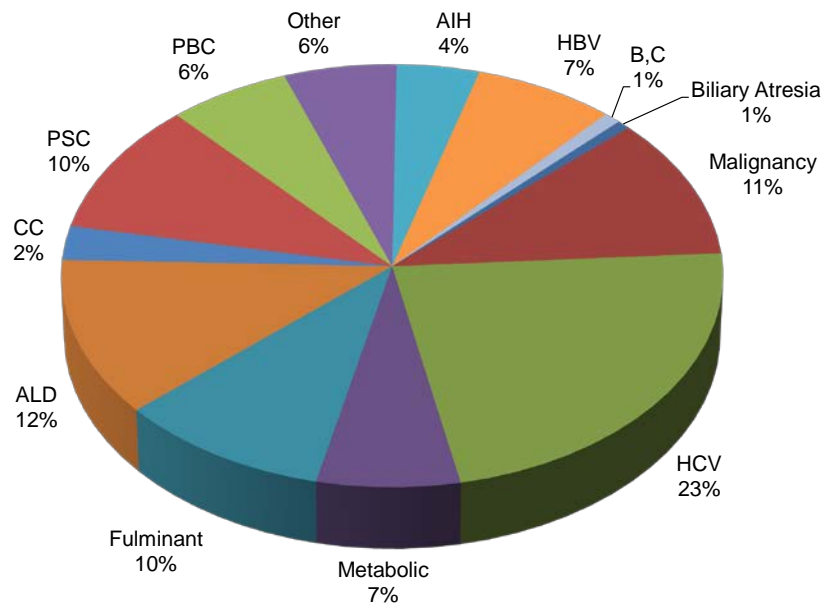


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The most common indications for transplantation are Chronic Hepatitis C (238, 18%), Biliary Atresia (138, 11%), Fulminant Liver Failure (130, 10%) and Alcoholic Disease (125, 10%).

### Primary Disease – Adults (n = 1043)

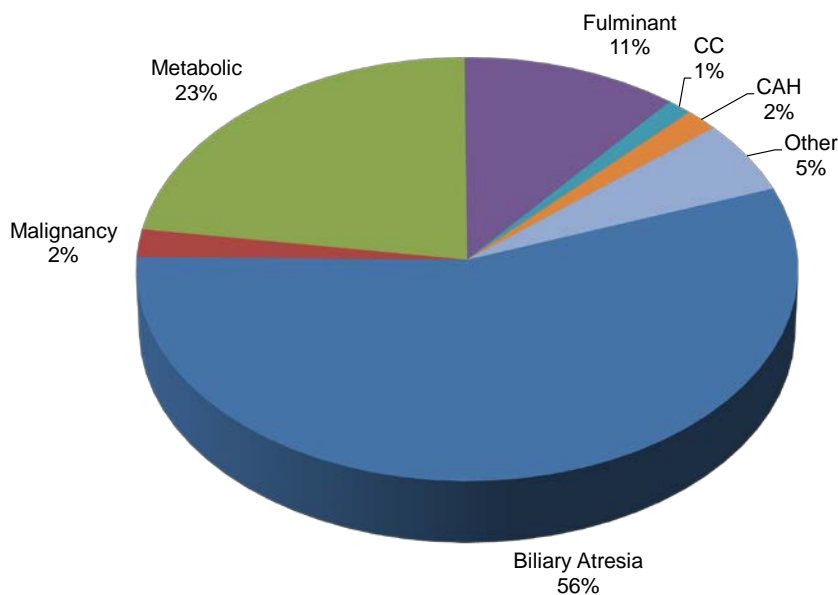


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Hepatitis C was the most common indication of transplantation in adults (238, 23%), followed by Alcoholic Liver Disease (ALD 125, 12%), Malignancy (113, 11%), Primary Sclerosing Cholangitis (PSC 106, 10%), Fulminant Hepatic Failure (104, 10%), and Hepatitis B (75, 7%).

### Primary Disease – Children (n = 235)

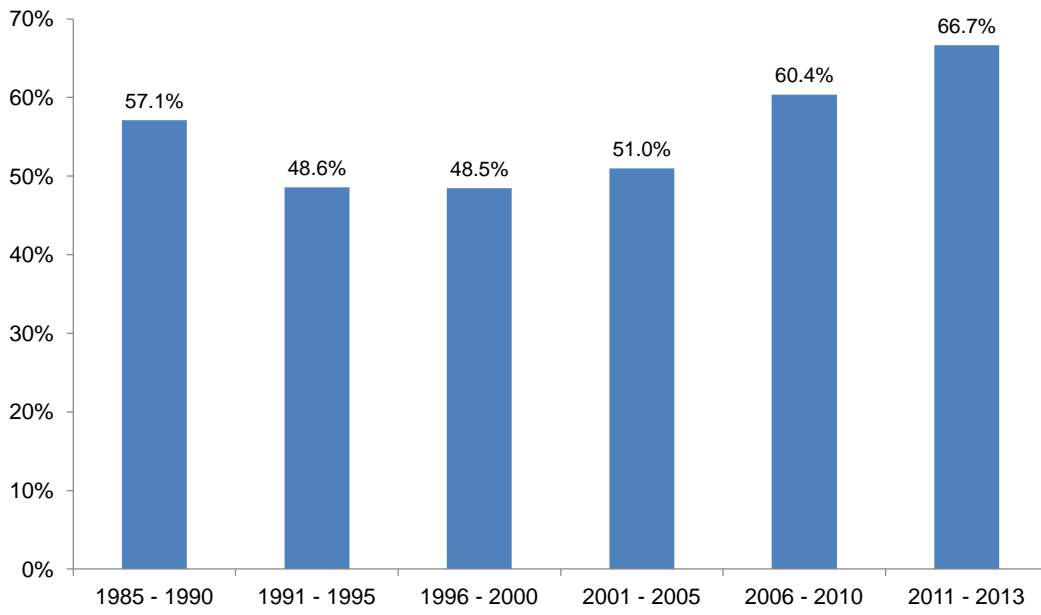


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The most common indication for transplantation in children was Biliary Atresia (131, 56%), followed by Metabolic disease (53, 24%) and Fulminant Hepatic Failure (26, 11%).

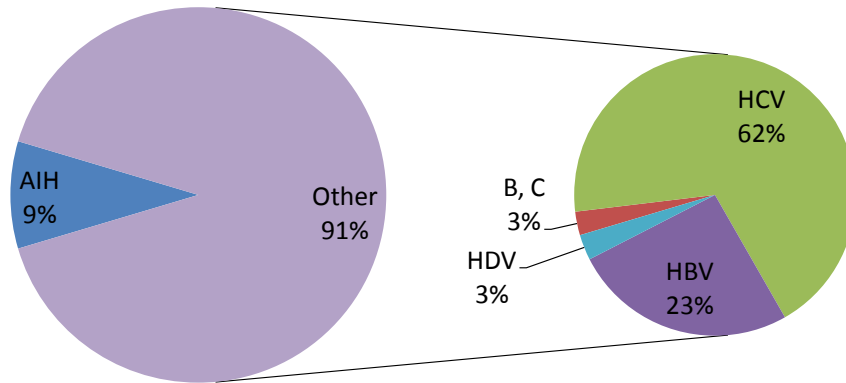
## Percentage of Children Transplanted for Biliary Atresia (n = 131; 56% of all Children)



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## Chronic Viral and Auto-Immune Hepatitis Primary and Secondary n = 495 (47.5% of all Adults)

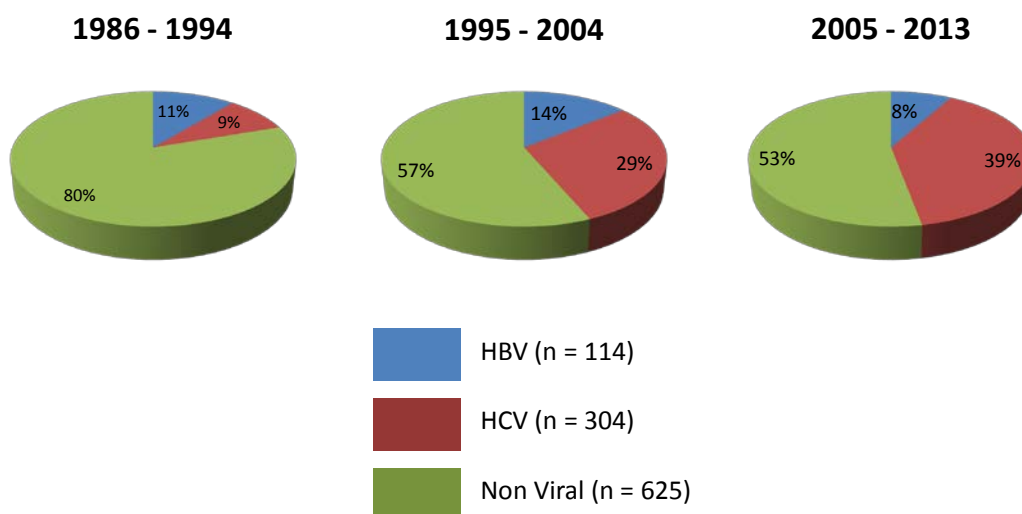


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Auto-Immune Hepatitis (AIH) comprised 9% of cases, the remainder (91%) being viral in origin (CVH). Of the cases of viral hepatitis, the most common is Hepatitis C (HCV, 62%), followed by Hepatitis B (HBV, 23%) and HBV/HCV co-infection (3%).

## Chronic Viral (Primary and Secondary) Adults by Era

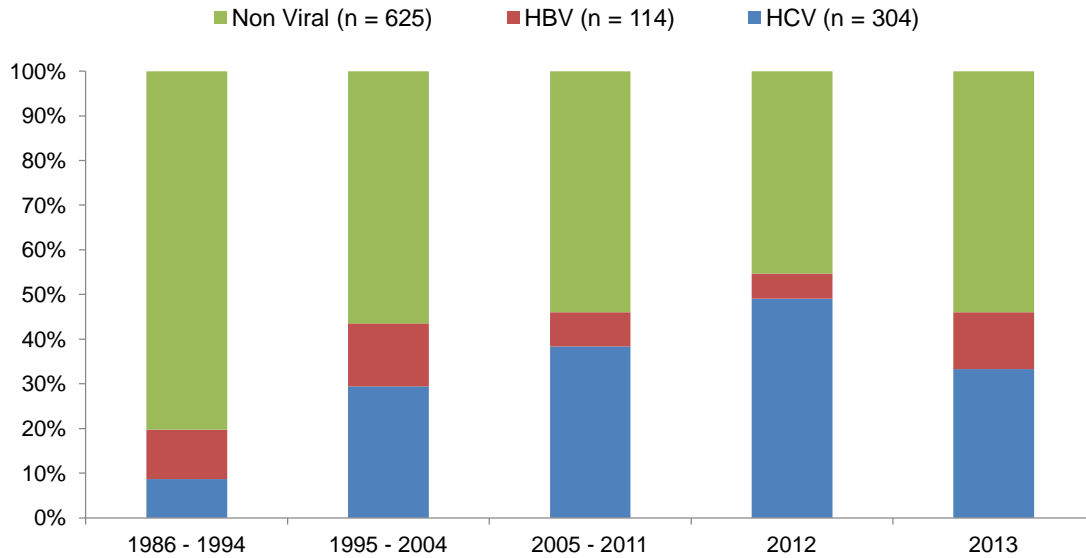


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Data to 31 December 2013

The number of patients requiring transplantation due to HCV has steadily increased over the three time periods. Whereas the number of patients requiring transplantation for HBV has now decreased.

## % Adults with Chronic HBV or HCV (Primary and Secondary)



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Data to 31 December 2013

Chronic HCV infection comprises 29.1% of adults transplanted, and is expected to continue to rise in the future.

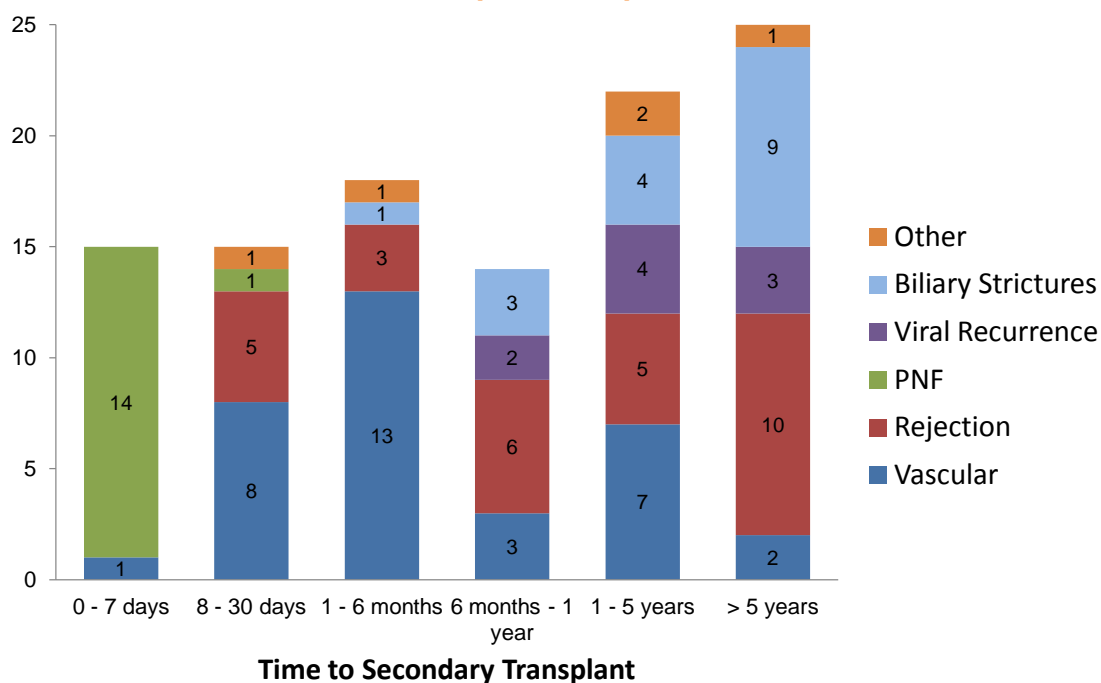
## Fulminant Hepatic Failure As Primary Indication Treated by Liver Transplantation

Aetiology	No of Patients	No of Tx	Outcome	
			Alive	Dead
Idiopathic	51	56	32	19
Drug Induced	21	22	15	6
Wilson's Disease	13	15	11	2
<b>Viral Hepatitis</b>				
Hep B	29	30	18	11
Hep C	1	1	1	0
Hep A	3	3	0	3
Hep E	1	1	0	1
Autoimmune Hepatitis	3	4	1	2
Budd-Chiari	1	1	0	1
Other	7	7	6	1
<b>Totals</b>	<b>130</b>	<b>140</b>	<b>84 (65% pts)</b>	<b>46 (35% pts)</b>

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Data to 31 December 2013

## Indication for Secondary Transplantation (n = 109)



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Primary non function (PNF) is the major indication for re-transplantation in the first 7 days. Rejection and vascular indications are prominent indications for re-transplantation in all other time periods.

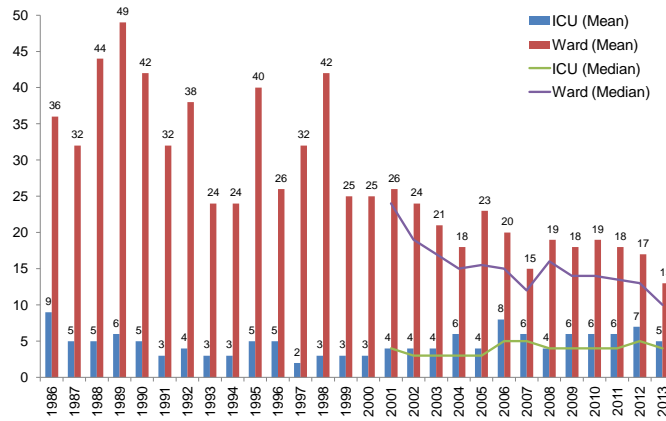




# PERIOPERATIVE DATA

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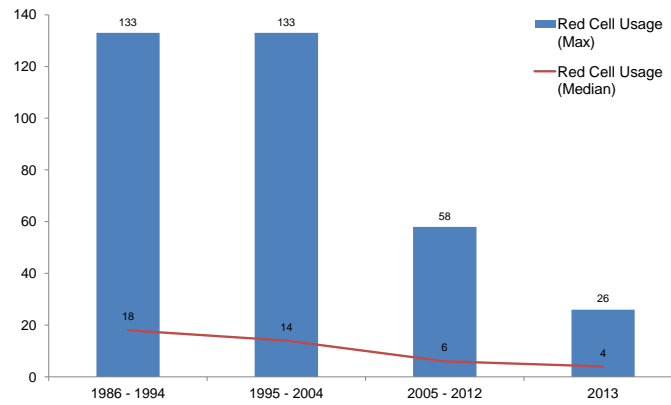
### Hospital Stay (Mean & Median Days) Adults Only



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### Red Cell Usage (Units of Packed Cells)



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Data to 31 December 2013

### Graft Ischaemic Time, Operation Duration And Red Cell Utilisation

	1986 – 1994	1995 – 2004	2005 – 2013
Mean Graft Ischaemic Time	9 hr 12 min	9 hr 16 min	8 hr 30 min
Mean Operation Time	7 hr 51 min	7 hr 43 min	7 hr 7 min
No. Of Packed Cells Utilised	1 – 133 Mean = 20.6; Median = 16	0 – 133 Mean = 16.0; Median = 12	0 – 58 Mean = 6.8; Median = 5

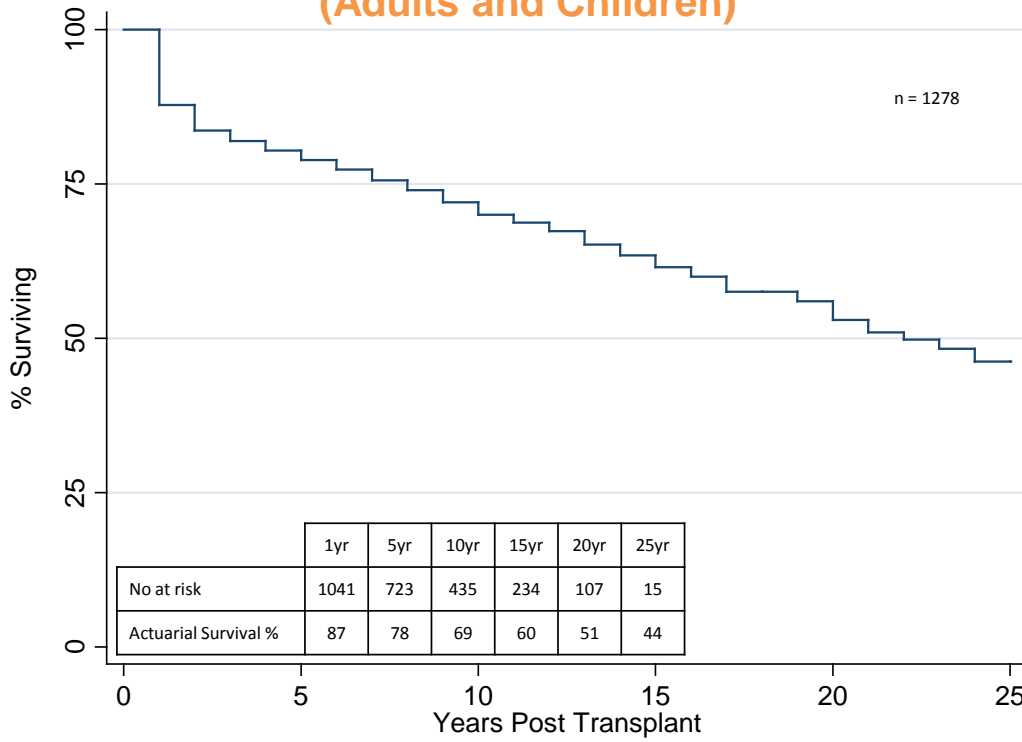
© copyright ANLTU

Data to 31 December 2013

# OUTCOME DATA

---

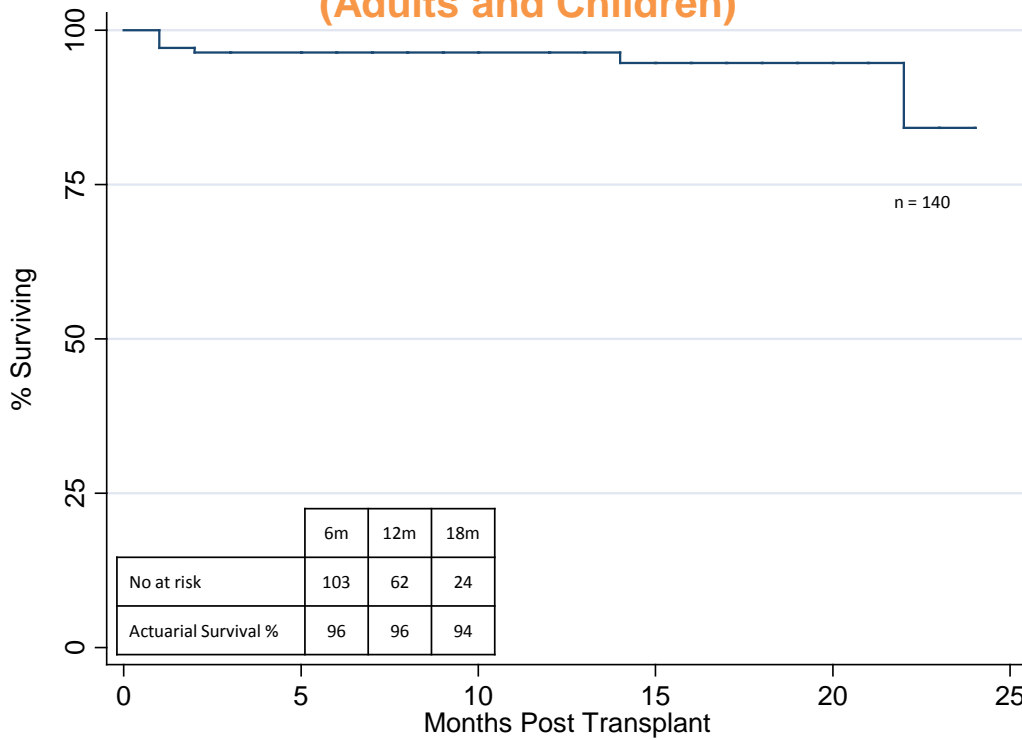
## Overall Patient Survival 1986 - 2013 (Adults and Children)



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Data to 31 December 2013

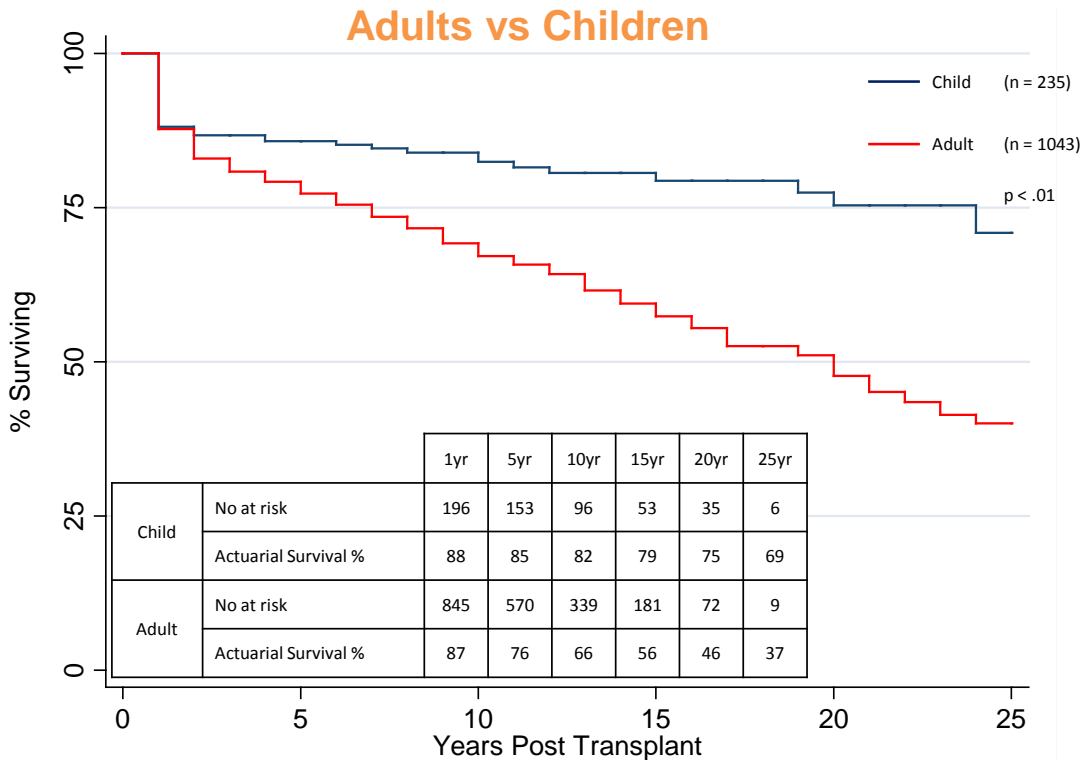
## Patient Survival 2012 - 2013 (Adults and Children)



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Data to 31 December 2013

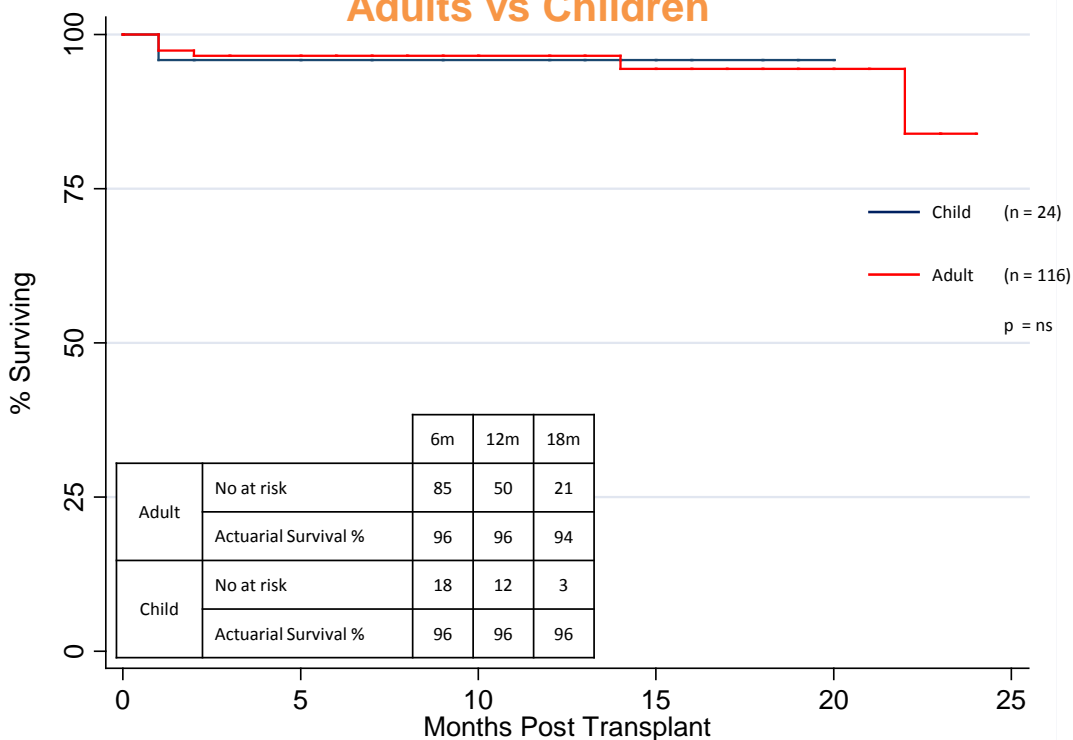
## Patient Survival 1986 – 2013 Adults vs Children



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Data to 31 December 2013

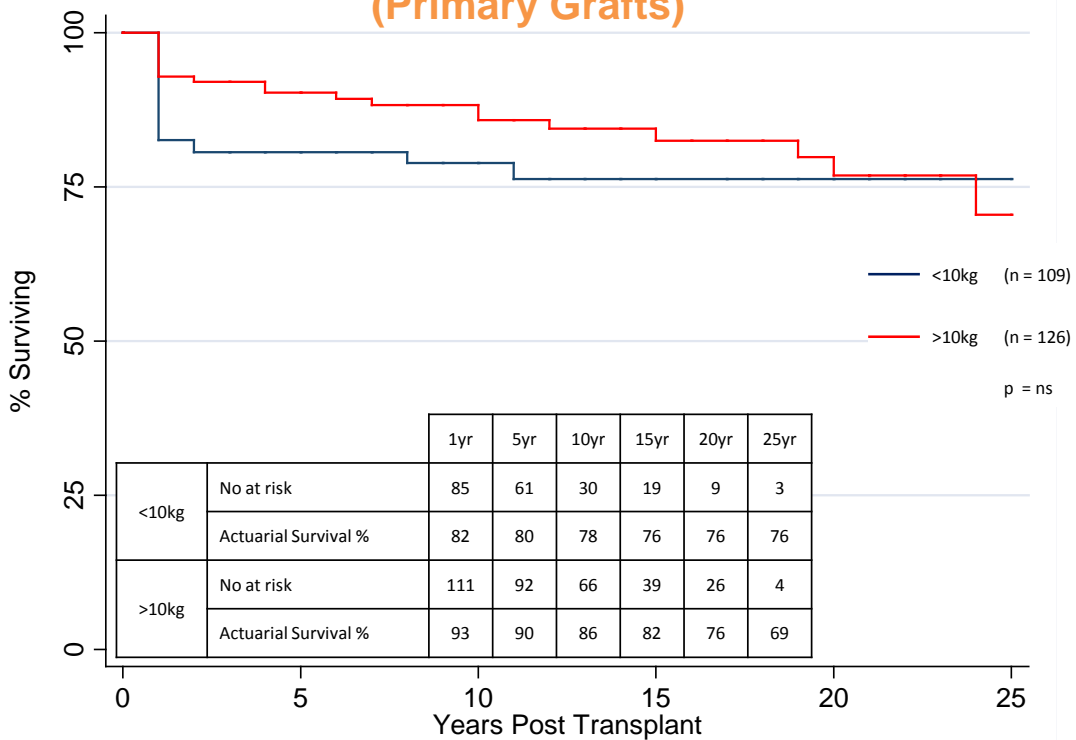
## Patient Survival 2012 - 2013 Adults vs Children



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Data to 31 December 2013

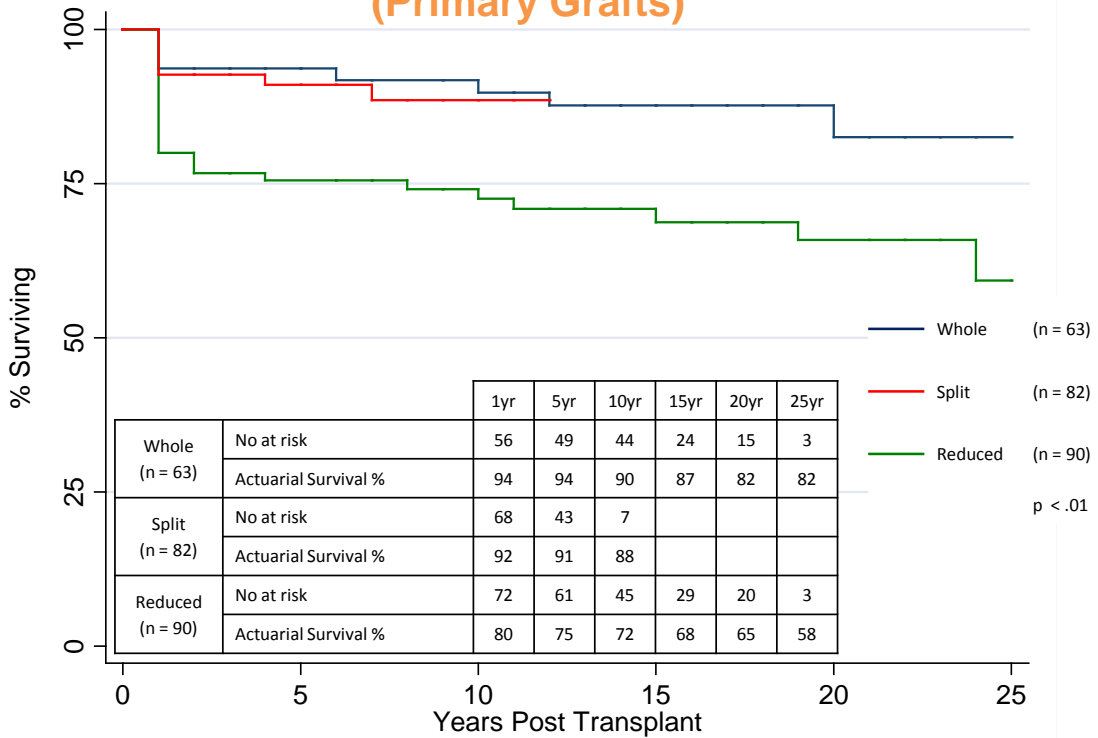
### Children – Weight vs Outcome (Primary Grafts)



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Data to 31 December 2013

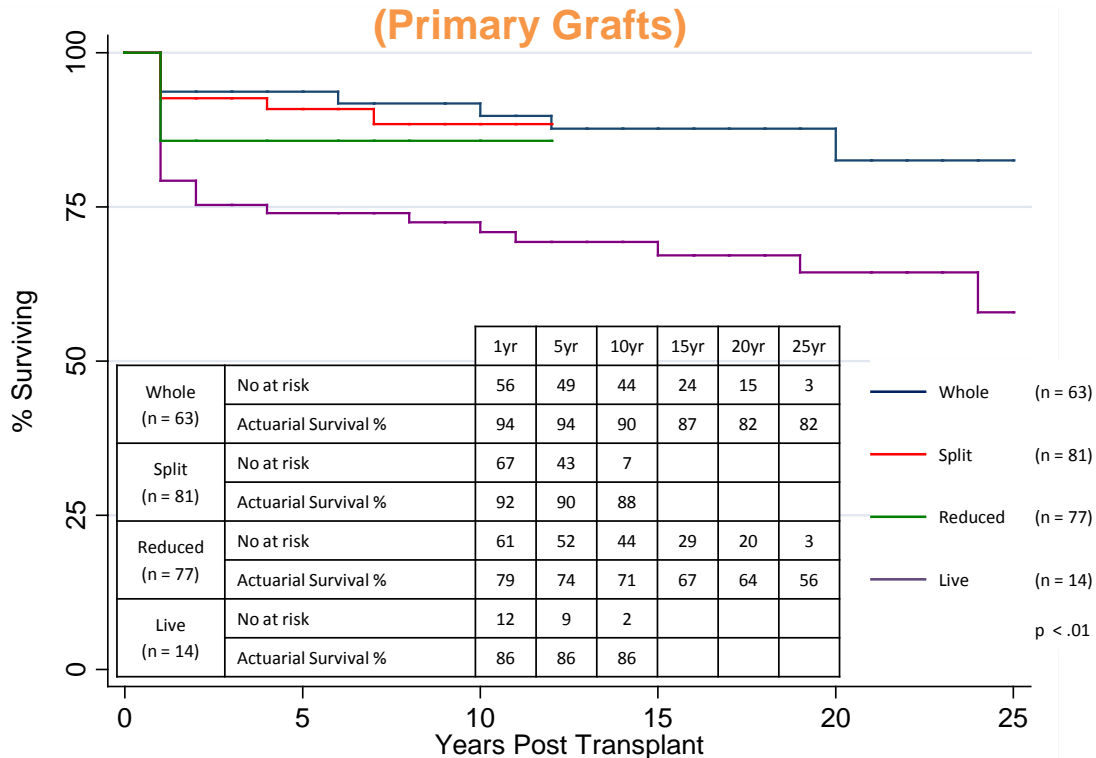
### Children – Type of Transplant vs Outcome (Primary Grafts)



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Data to 31 December 2013

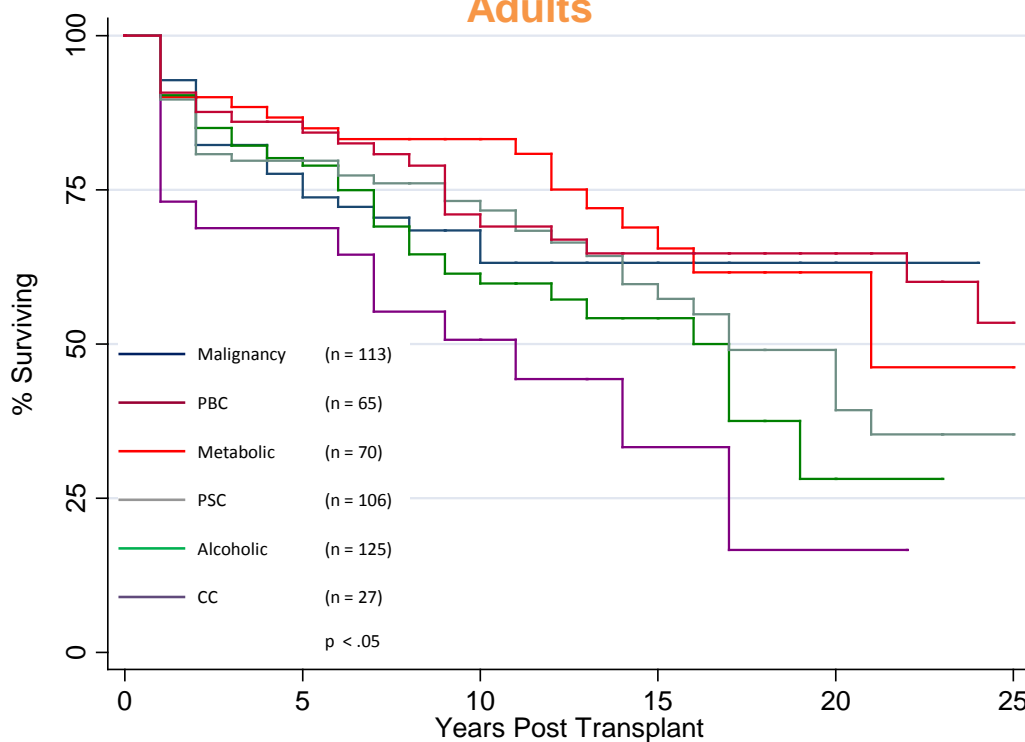
### Children – Donor Type (Primary Grafts)



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Data to 31 December 2013

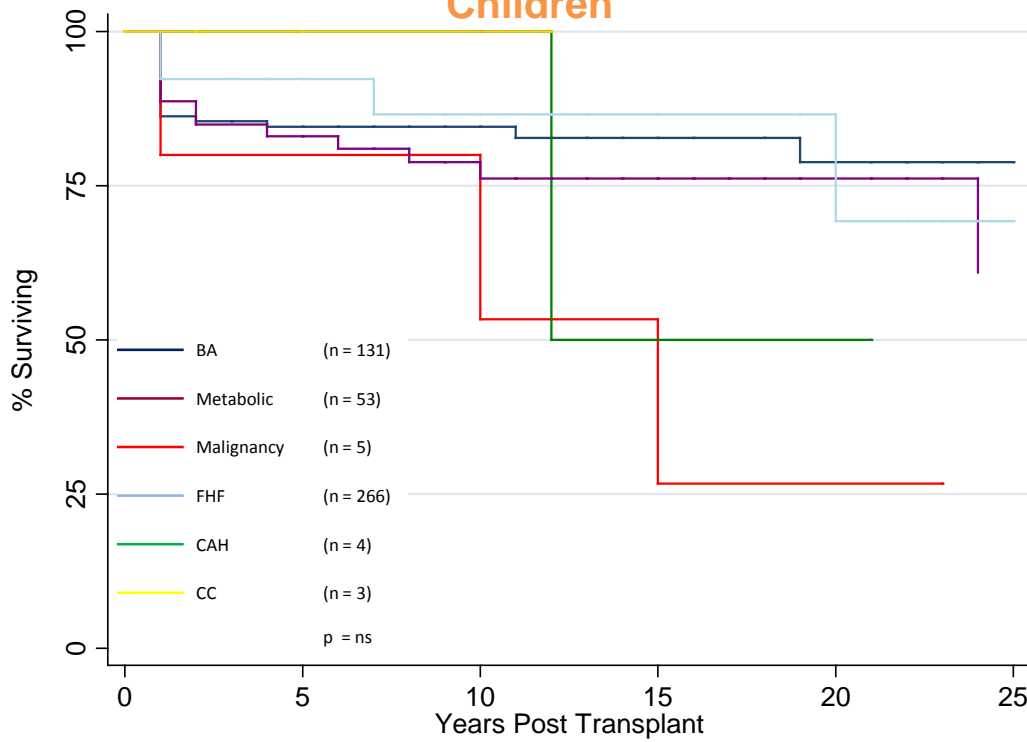
### Primary Disease vs Outcome Adults



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Data to 31 December 2013

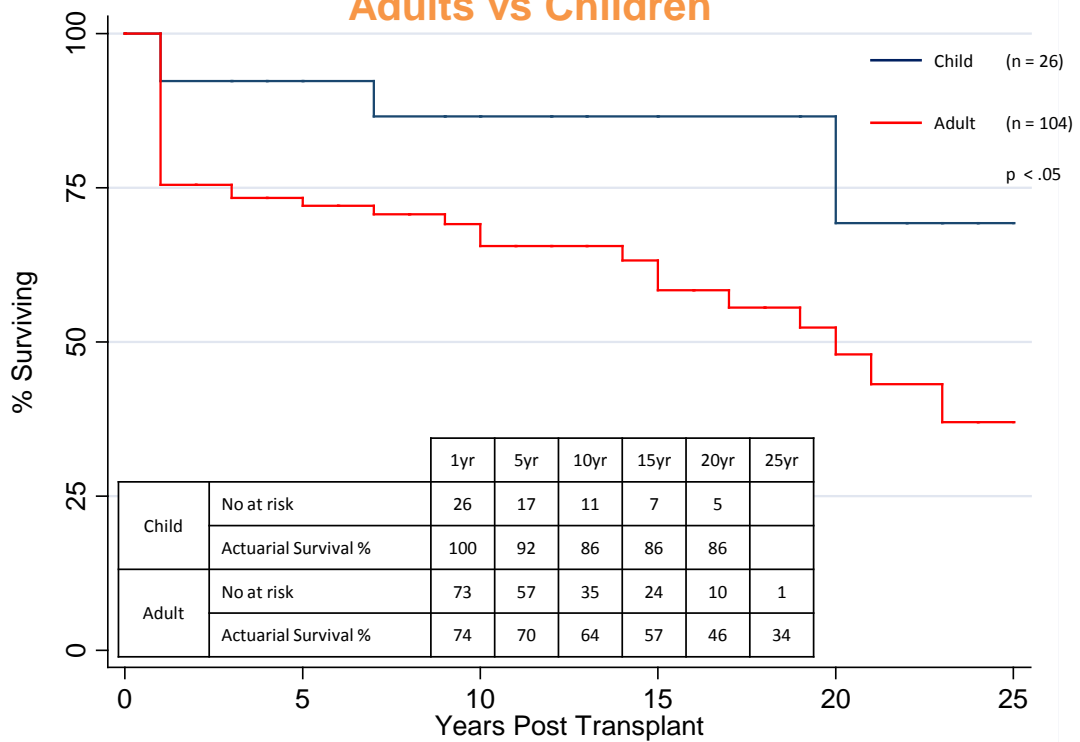
### Primary Disease vs Outcome Children



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Data to 31 December 2013

### Fulminant Disease vs Outcome Adults vs Children

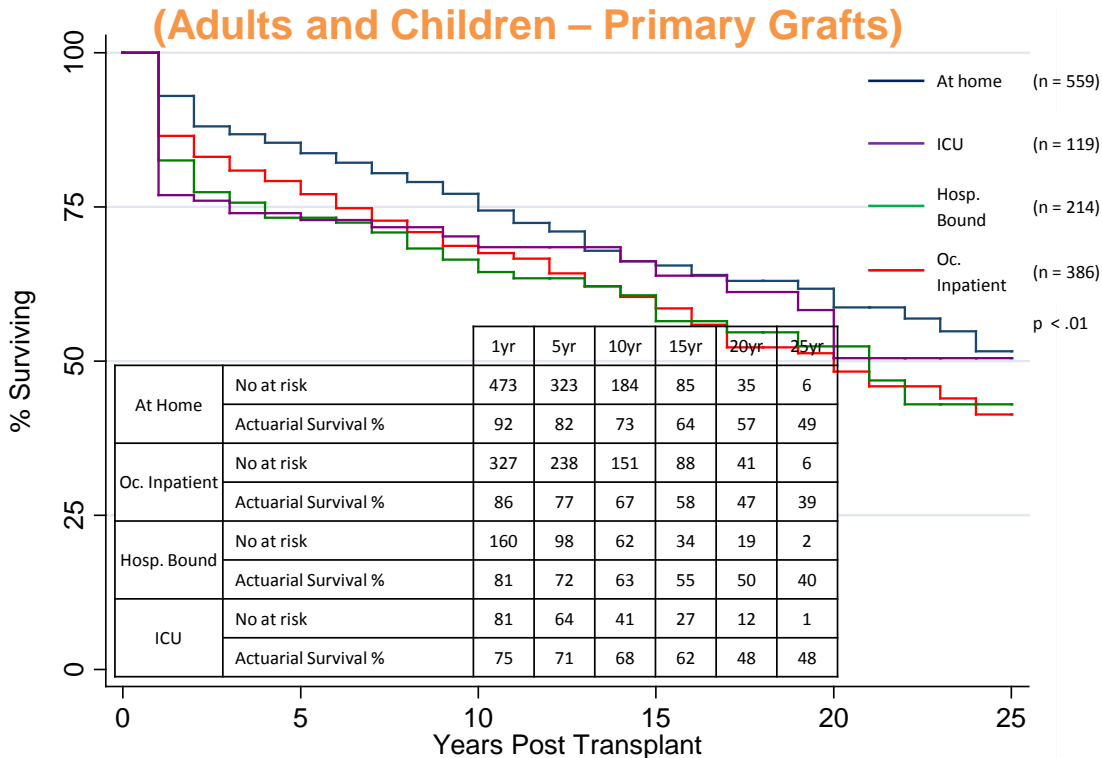


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Data to 31 December 2013



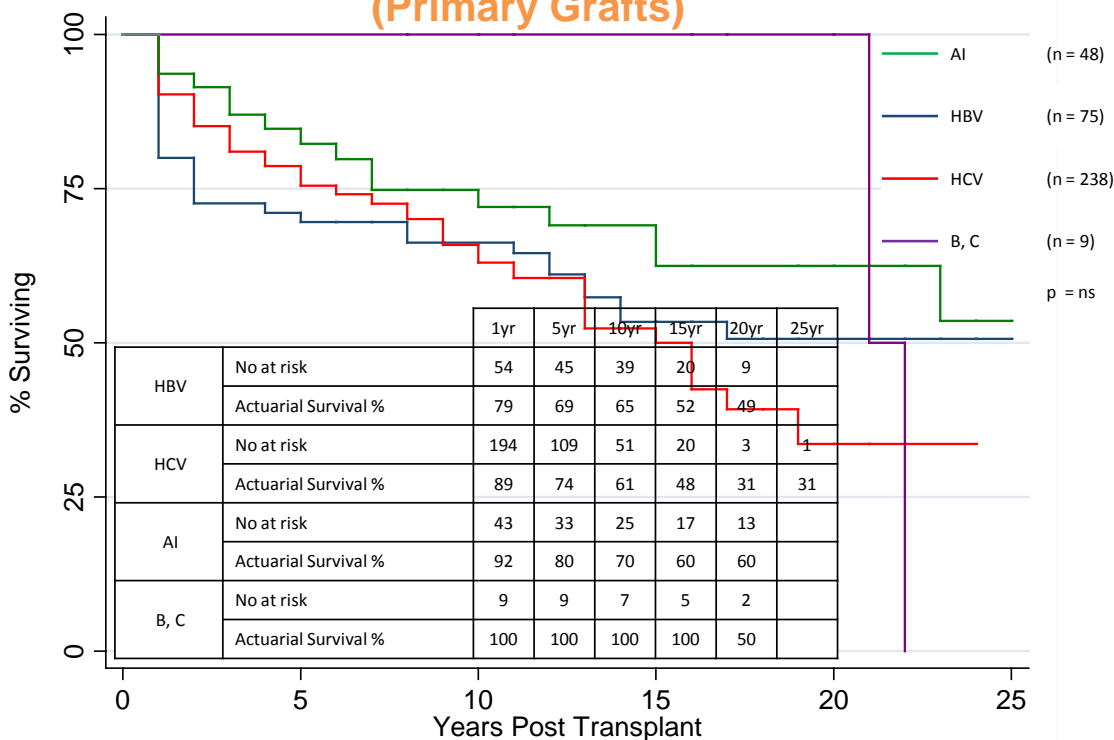
## Status vs Outcome (Adults and Children – Primary Grafts)



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Data to 31 December 2013

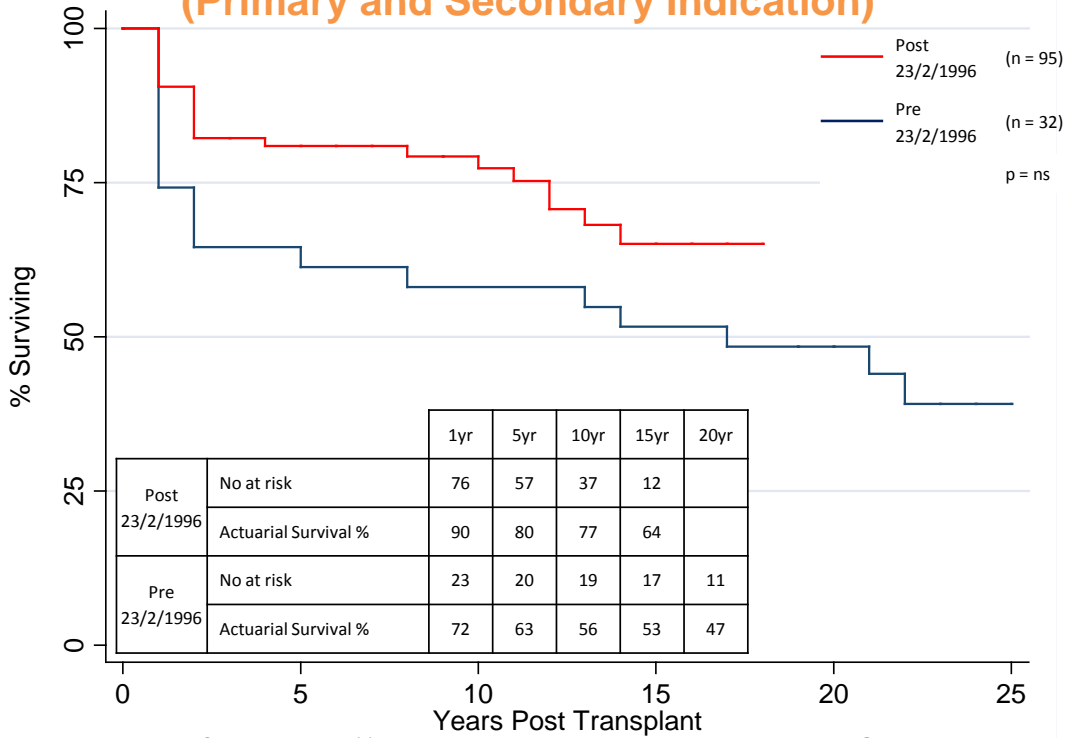
## Chronic Viral, Autoimmune Disease vs Outcome (Primary Grafts)



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Data to 31 December 2013

## Chronic HBV Before and After Prophylaxis Protocol\* (Primary and Secondary Indication)

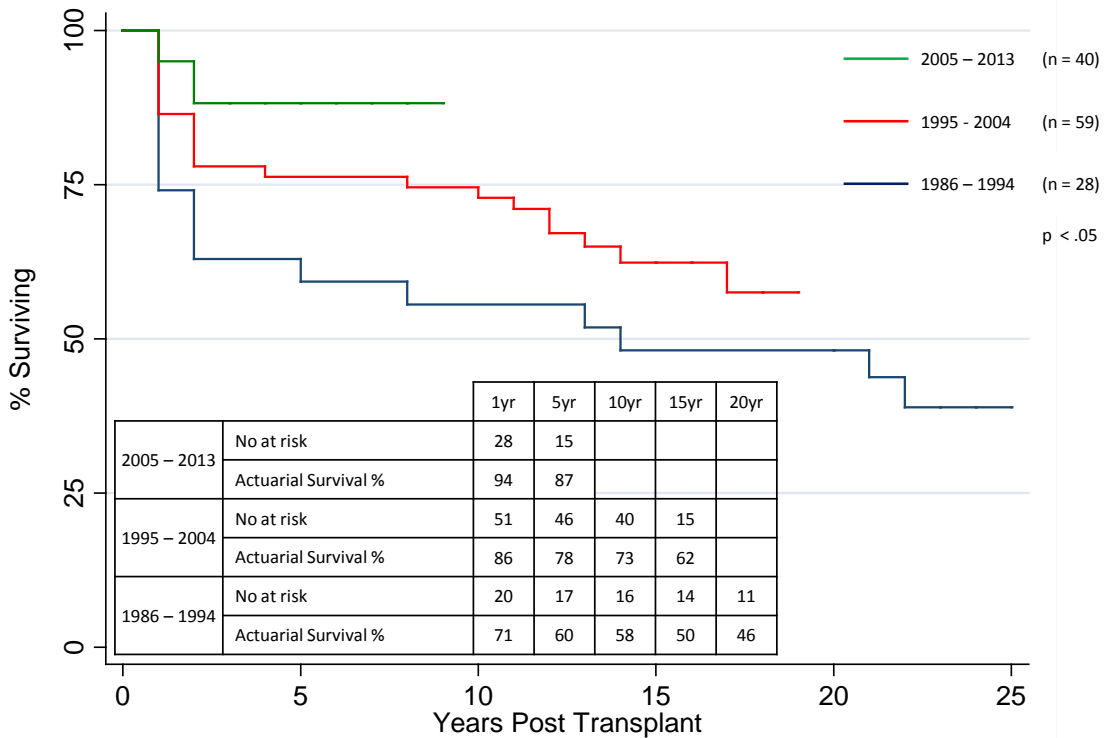


\* Oral nucleos(t)ide therapy + low dose monthly IMI HBIG

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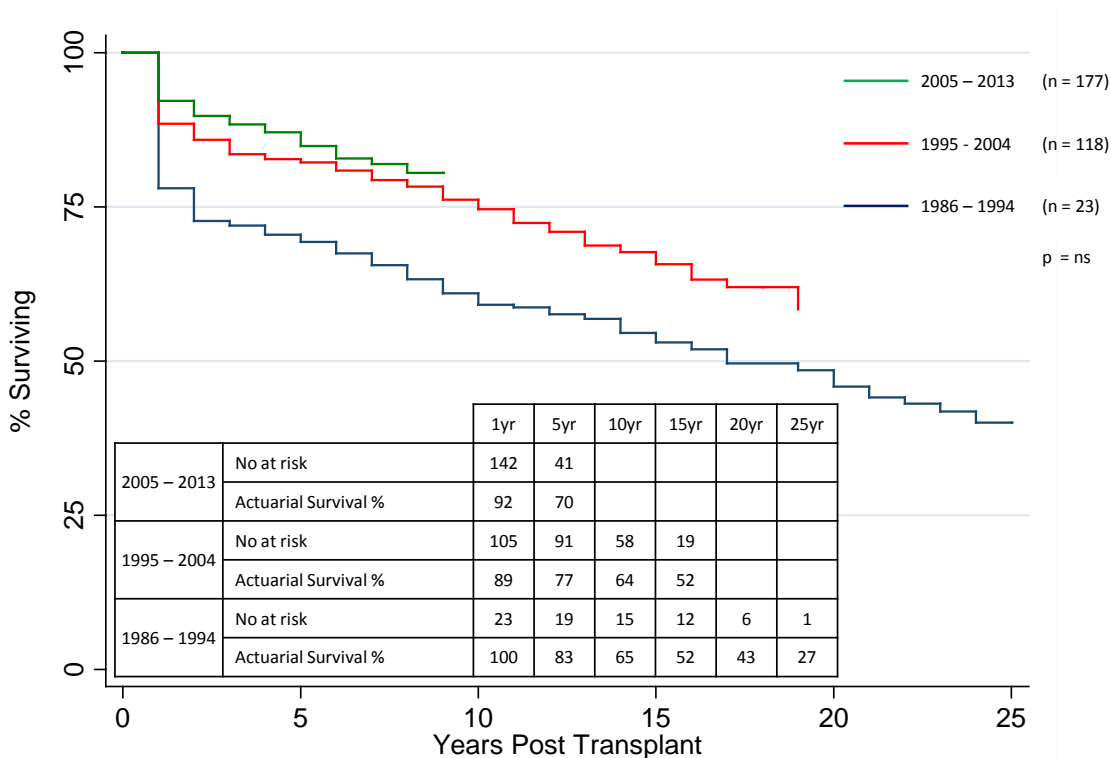
## Chronic HBV (Primary and Secondary) vs Era



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Data to 31 December 2013

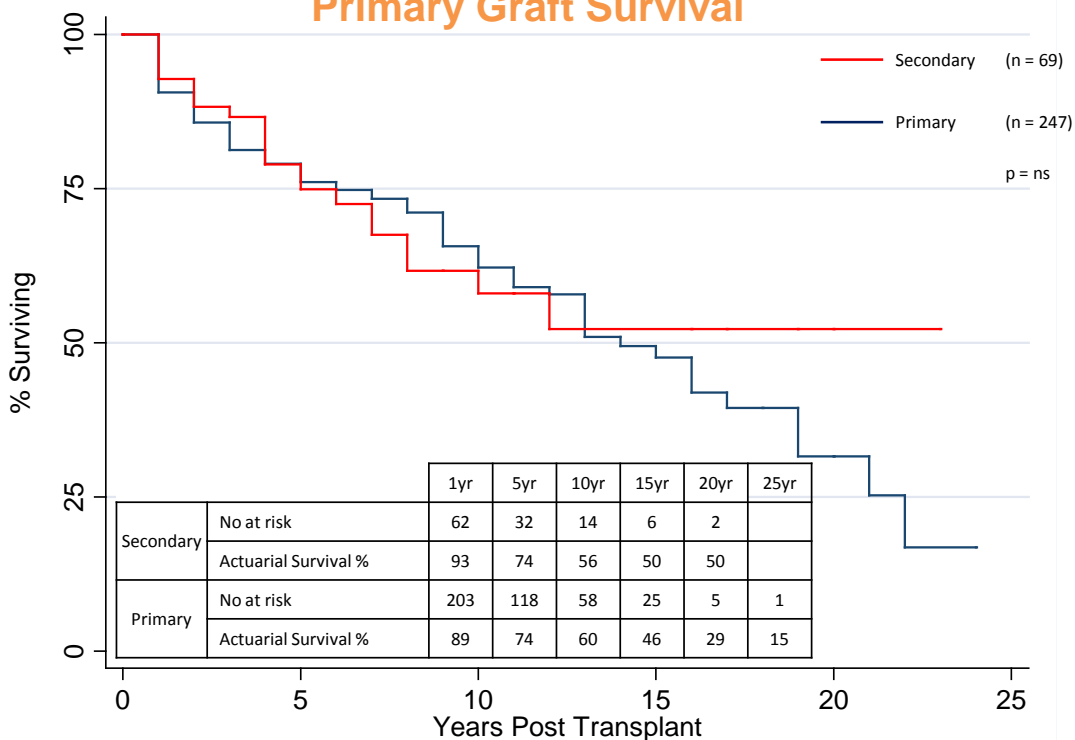
## Chronic HCV (Primary and Secondary) vs Era



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Data to 31 December 2013

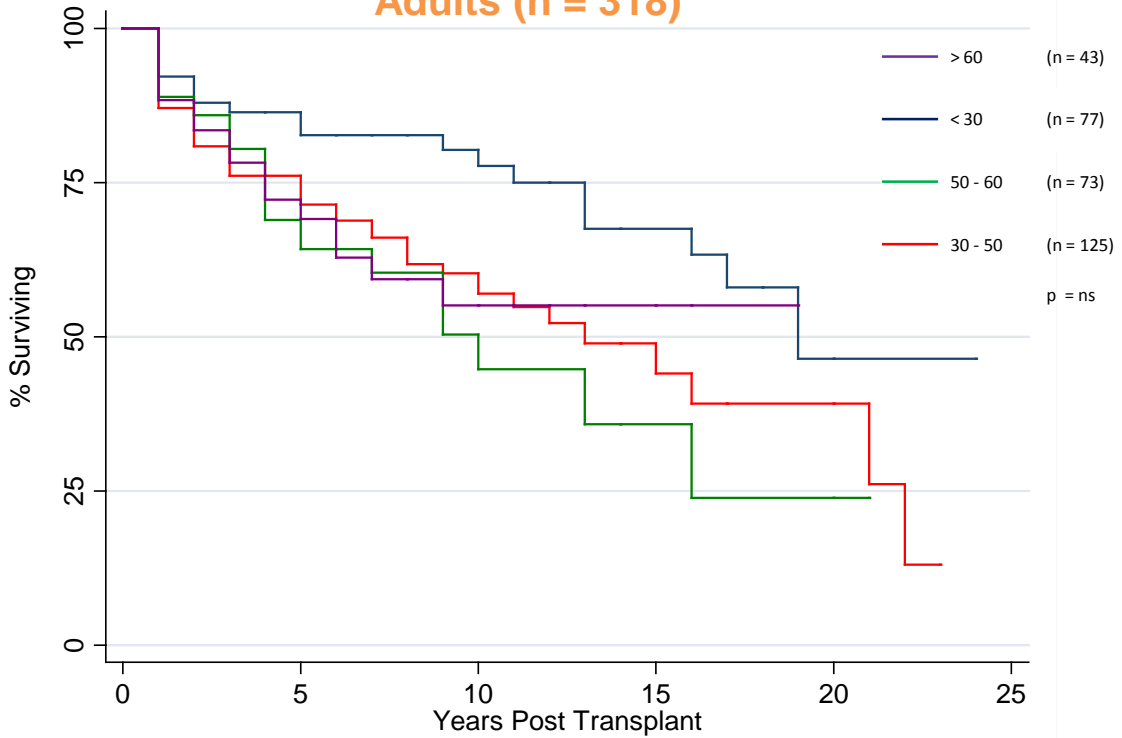
## Chronic HCV Primary vs Secondary Indication Primary Graft Survival



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Data to 31 December 2013

## HCV vs Donor Age vs Primary Graft Outcome Adults (n = 318)



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Data to 31 December 2013

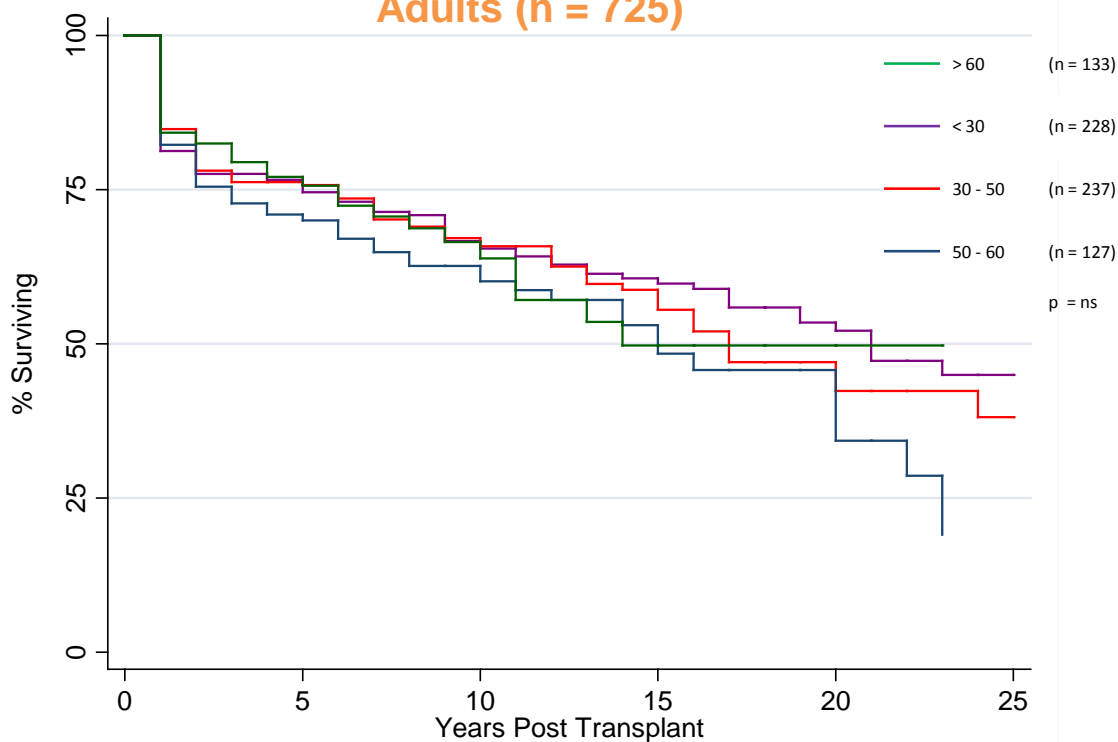
## HCV vs Donor Age vs Primary Graft Outcome Adults (n = 318)

		1yr	5yr	10yr	15yr	20yr	25yr
>60 (n = 43)	No at risk	36	22	7	2		
	Actuarial Survival %	88	68	54	54		
<30 (n = 77)	No at risk	65	42	29	16	4	1
	Actuarial Survival %	87	82	77	67	44	44
50 - 60 (n = 73)	No at risk	60	22	9	3	1	
	Actuarial Survival %	87	62	48	33	22	
30 - 50 (n = 125)	No at risk	98	55	26	9	3	
	Actuarial Survival %	86	70	55	42	36	

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Data to 31 December 2013

## Non HCV vs Donor Age vs Primary Graft Outcome Adults (n = 725)



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Data to 31 December 2013

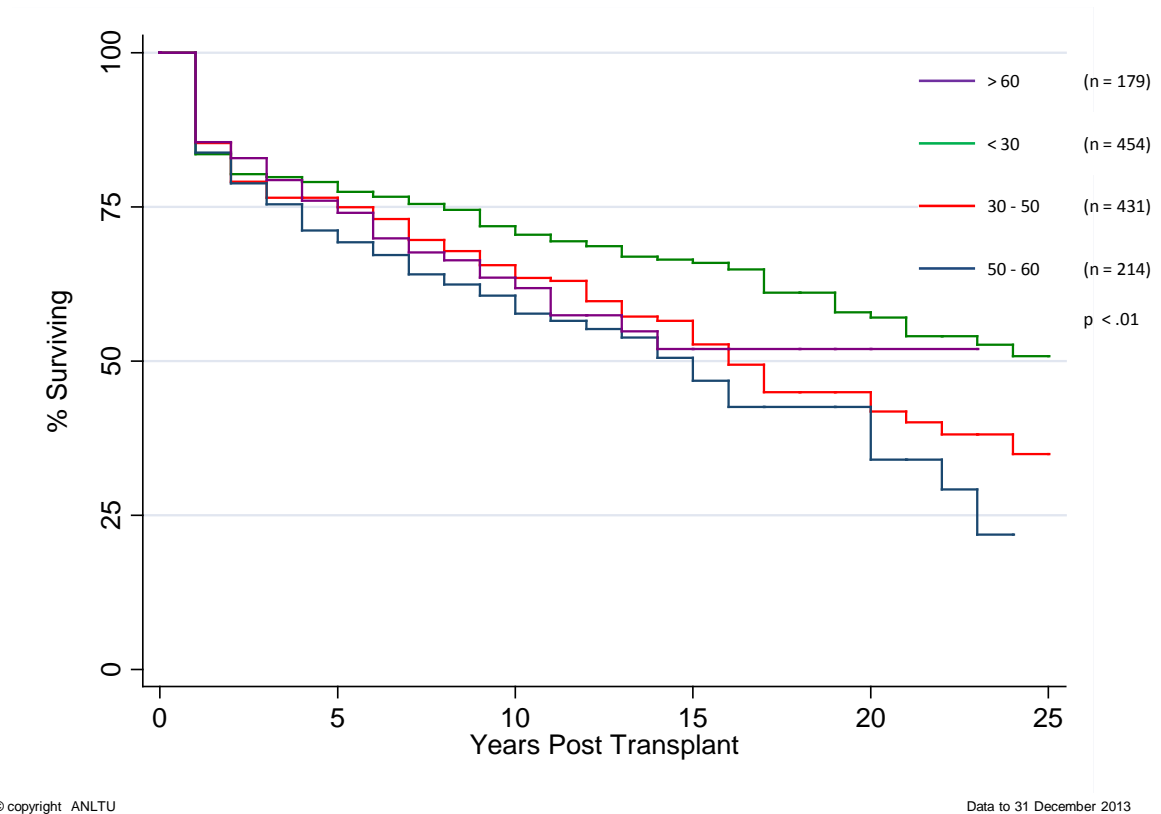
## Non HCV vs Donor Age vs Primary Graft Outcome Adults (n = 725)

		1yr	5yr	10yr	15yr	20yr	25yr
>60 (n = 133)	No at risk	96	47	19	7	2	
	Actuarial Survival %	83	74	62	47	47	
<30 (n = 228)	No at risk	176	143	103	70	32	6
	Actuarial Survival %	80	73	64	58	50	43
30 - 50 (n = 237)	No at risk	188	141	87	47	16	1
	Actuarial Survival %	84	75	65	55	41	36
50 - 60 (n = 127)	No at risk	97	71	42	18	9	
	Actuarial Survival %	80	68	58	46	32	

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Data to 31 December 2013

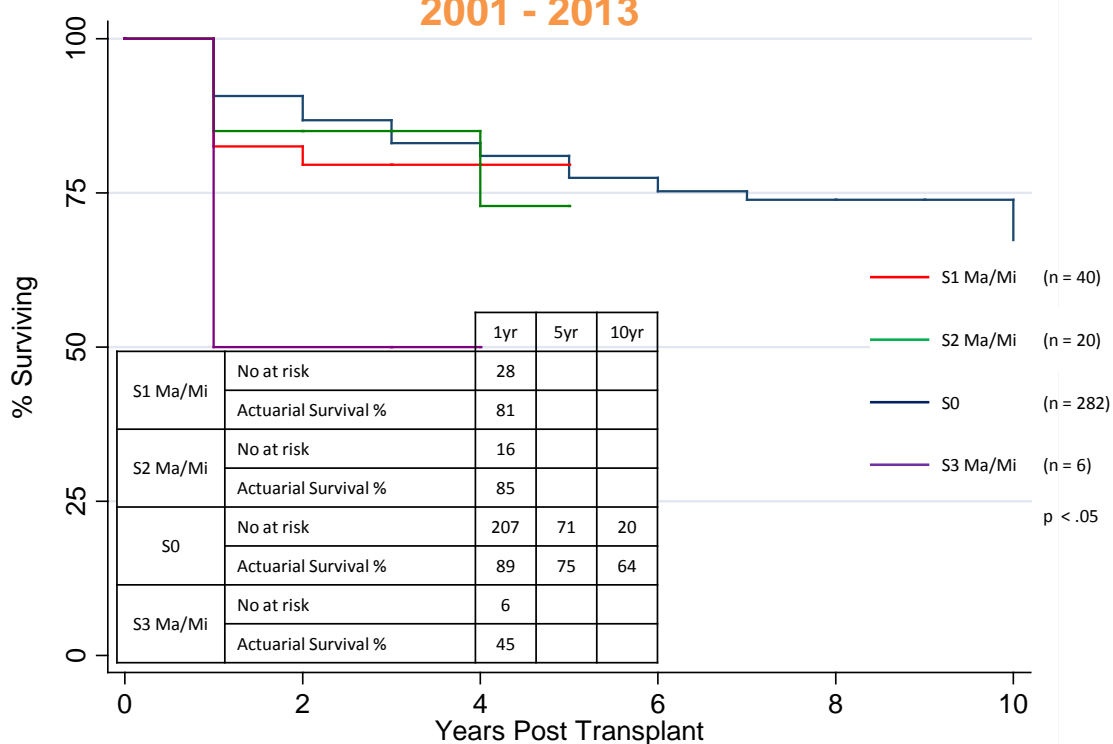
## Donor Age vs Primary Graft Outcome



## Donor Age vs Primary Graft Outcome

		1yr	5yr	10yr	15yr	20yr	25yr
>60 (n = 179)	No at risk	134	71	28	15	4	
	Actuarial Survival %	85	73	60	50	50	
<30 (n = 454)	No at risk	360	277	195	121	57	10
	Actuarial Survival %	83	76	69	65	55	49
30 - 50 (n = 431)	No at risk	339	235	129	64	24	3
	Actuarial Survival %	85	74	62	51	40	33
50 - 60 (n = 214)	No at risk	167	101	49	22	7	
	Actuarial Survival %	82	67	55	44	32	

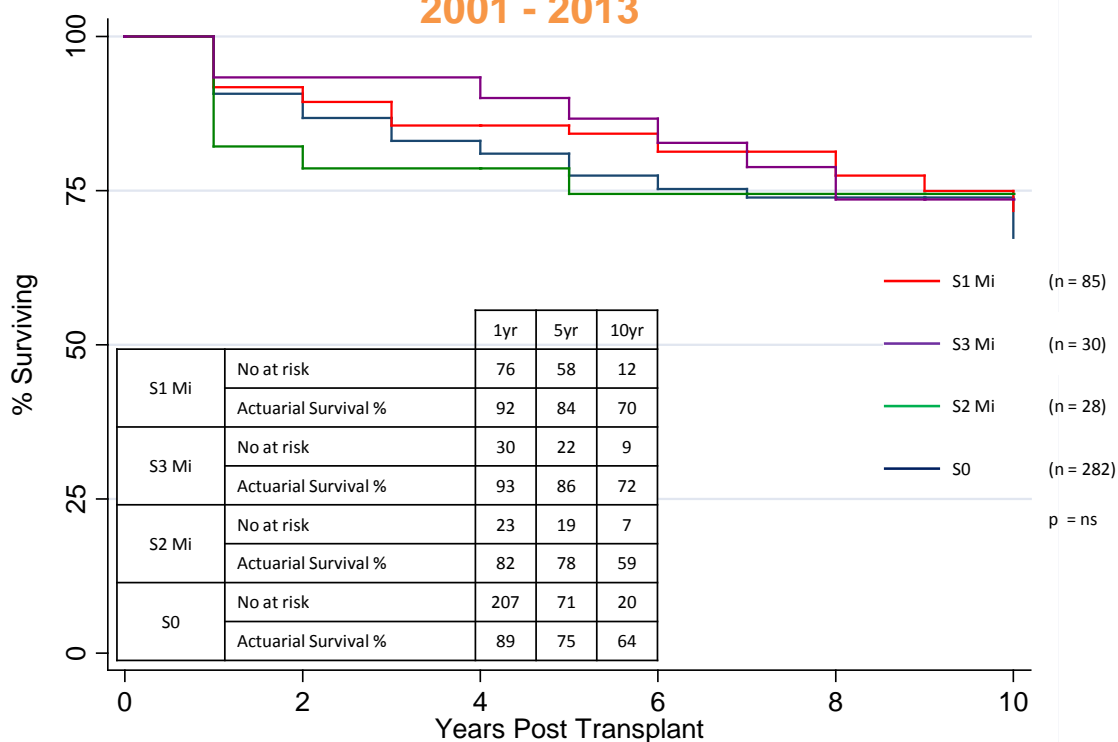
## Macro Steatosis vs Primary Graft Outcome (Adults) 2001 - 2013



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Data to 31 December 2013

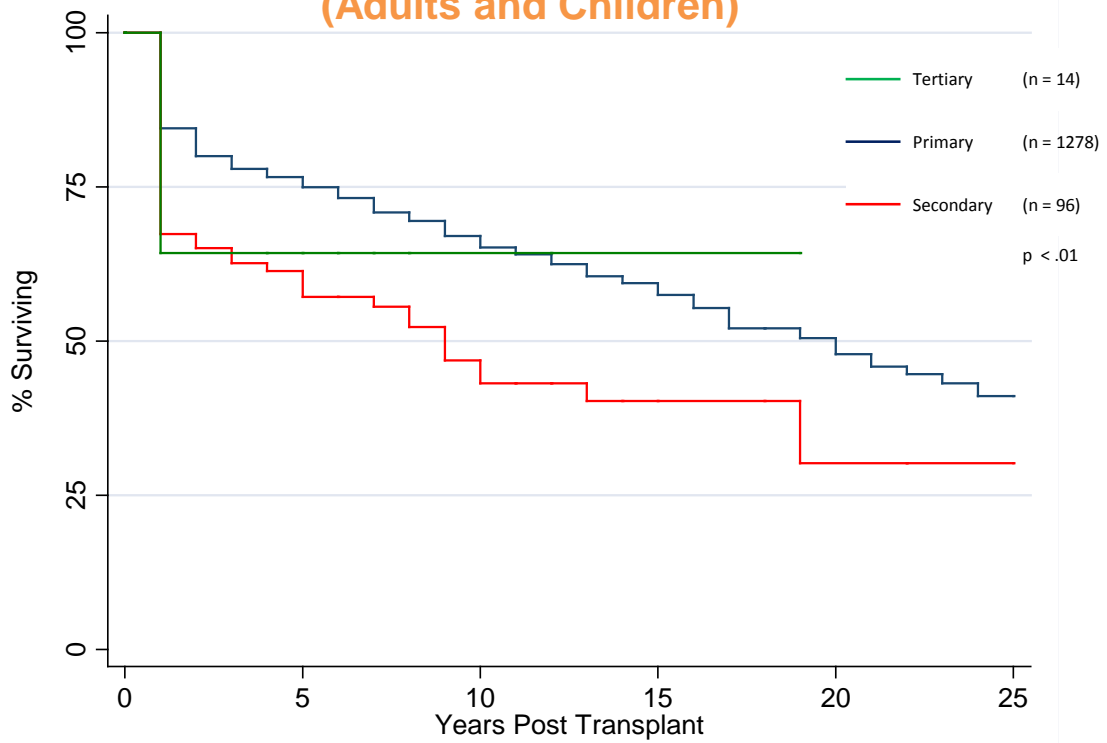
## Micro Steatosis vs Primary Graft Outcome (Adults) 2001 - 2013



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Data to 31 December 2013

### Graft Survival by Graft No (Adults and Children)



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Data to 31 December 2013

### Graft Survival by Graft No (Adults and Children)

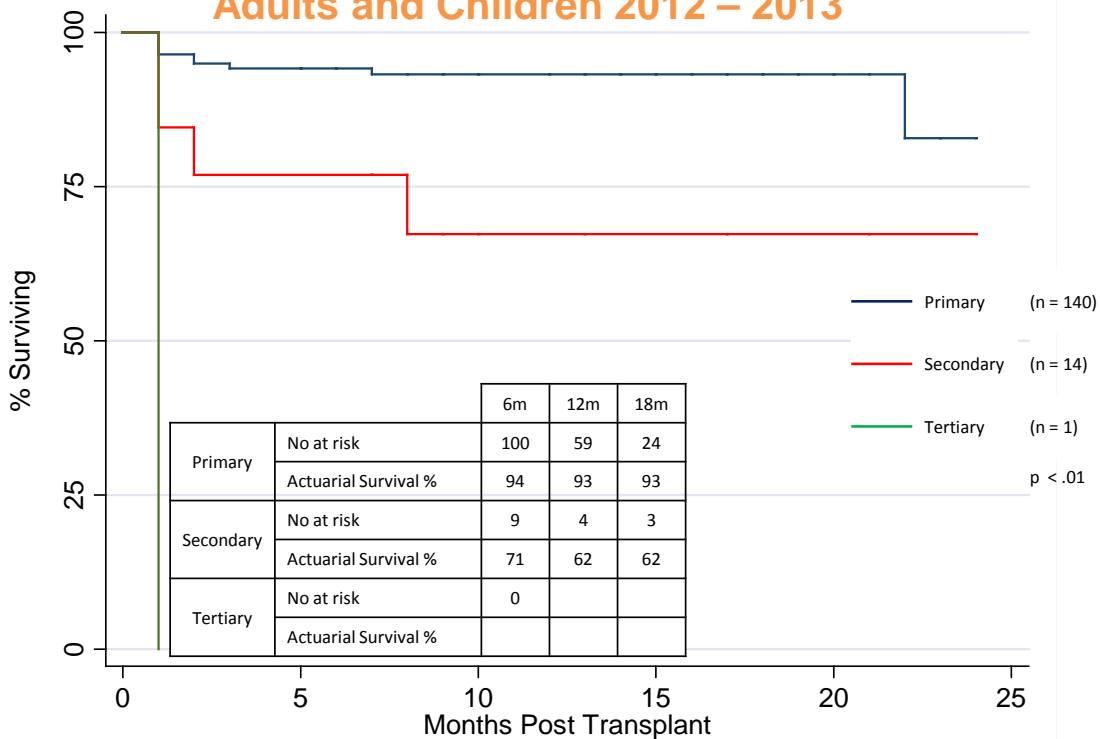
		1yr	5yr	10yr	15yr	20yr	25yr
Tertiary (n = 14)	No at risk	14	8	3	2		
	Actuarial Survival %	64	64	64	64		
Primary (n = 1278)	No at risk	1000	684	401	218	95	13
	Actuarial Survival %	83	74	64	56	46	39
Secondary (n = 96)	No at risk	59	37	21	12	8	
	Actuarial Survival %	66	55	41	39	39	

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Data to 31 December 2013



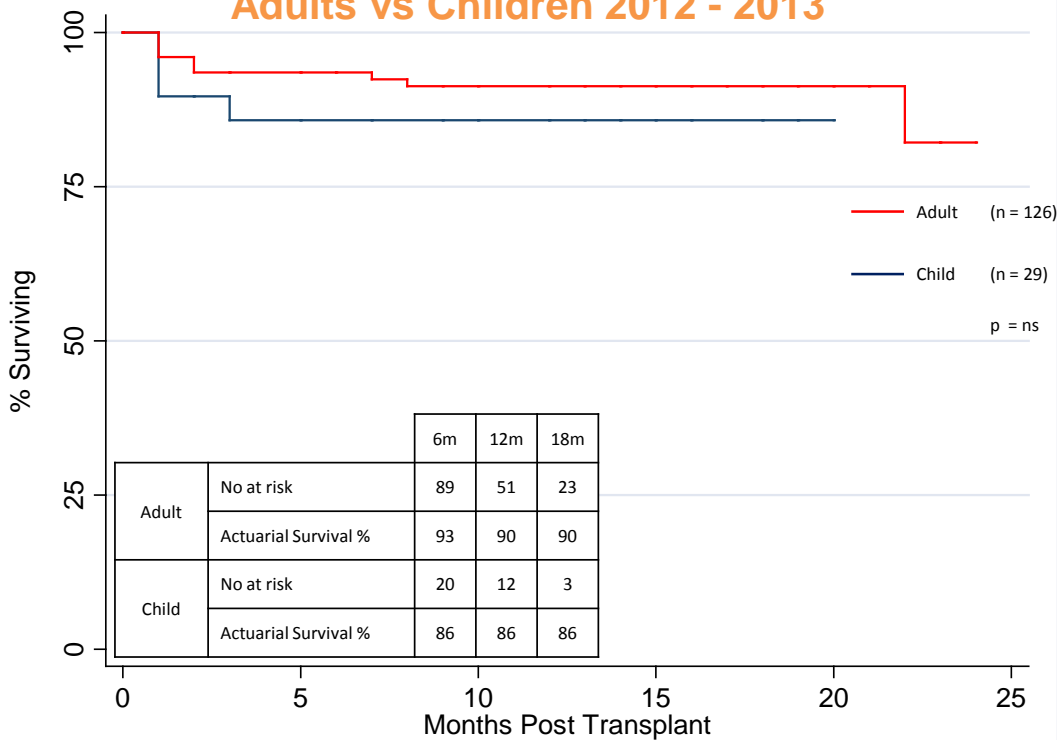
### Graft Survival by Graft No Adults and Children 2012 – 2013



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Data to 31 December 2013

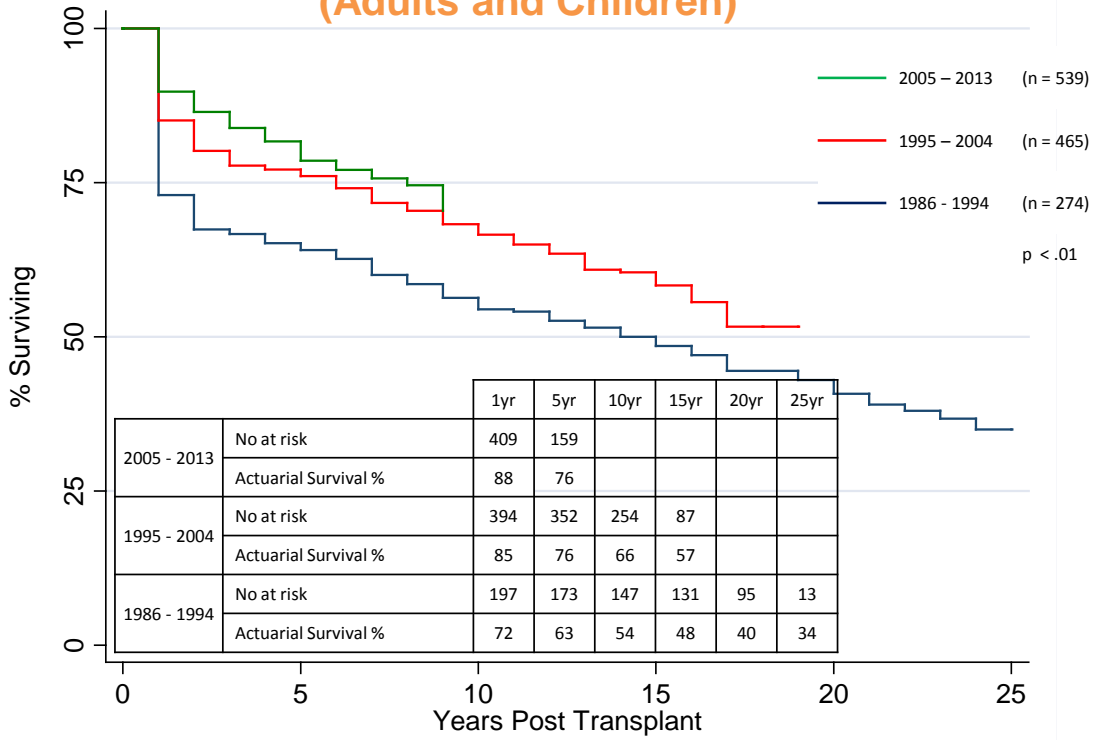
### Graft Survival Adults vs Children 2012 - 2013



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Data to 31 December 2013

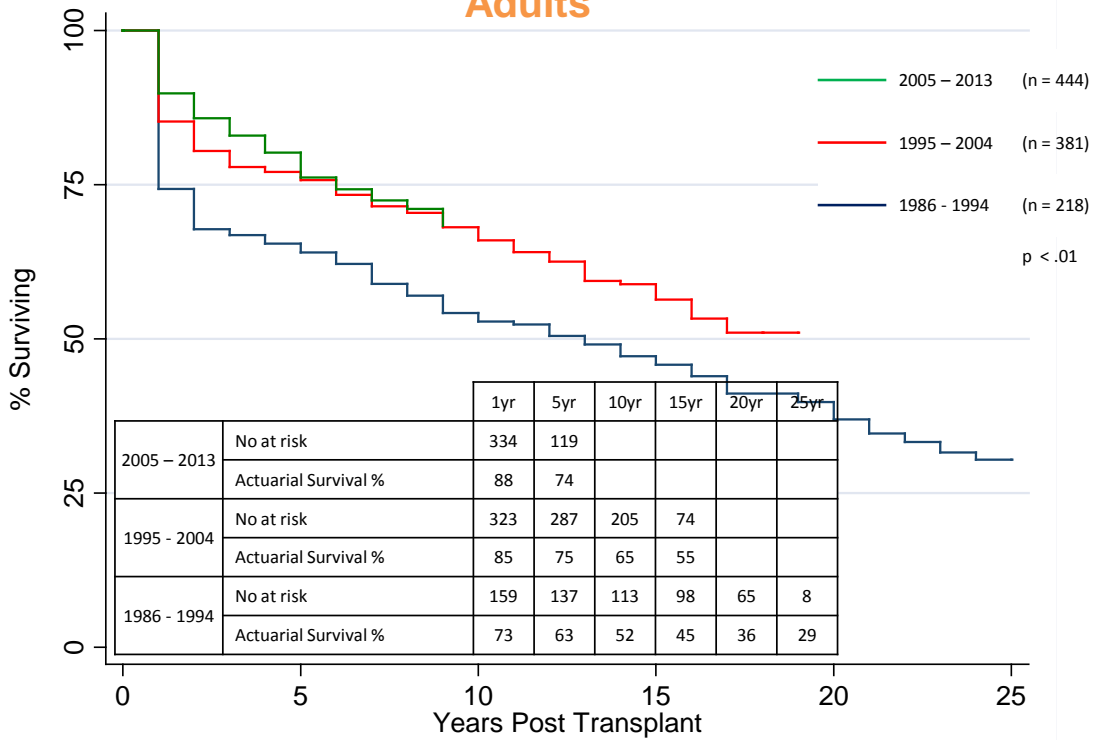
## Primary Graft Survival by Era (Adults and Children)



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Data to 31 December 2013

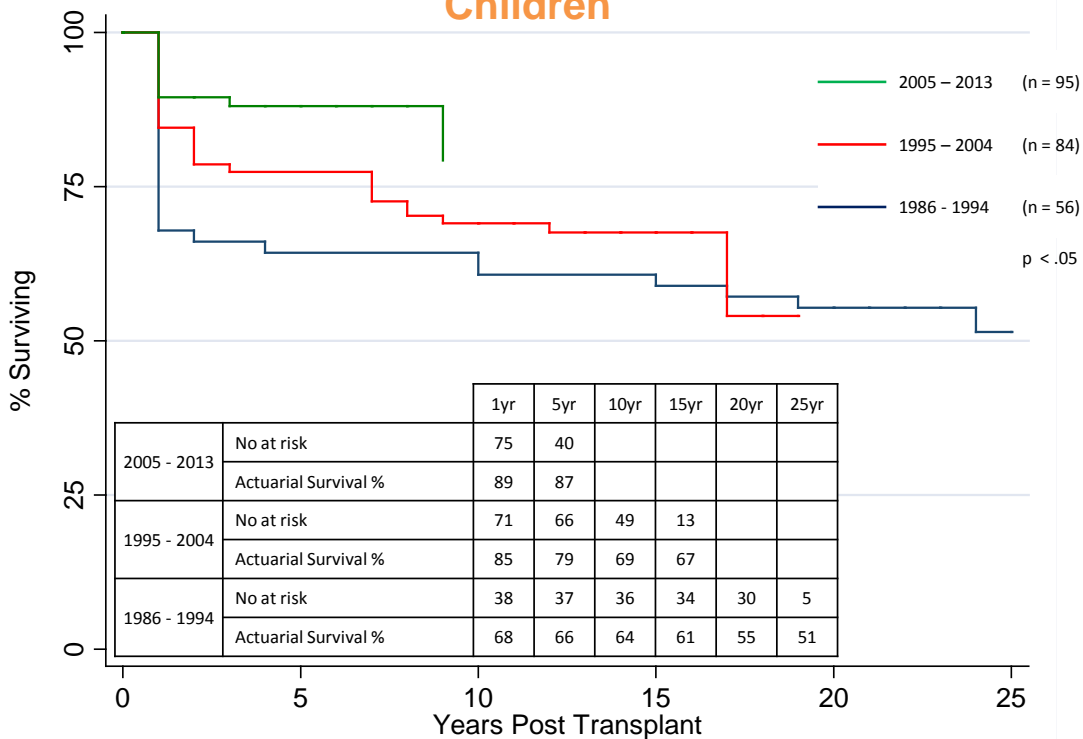
## Primary Graft Survival by Era Adults



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Data to 31 December 2013

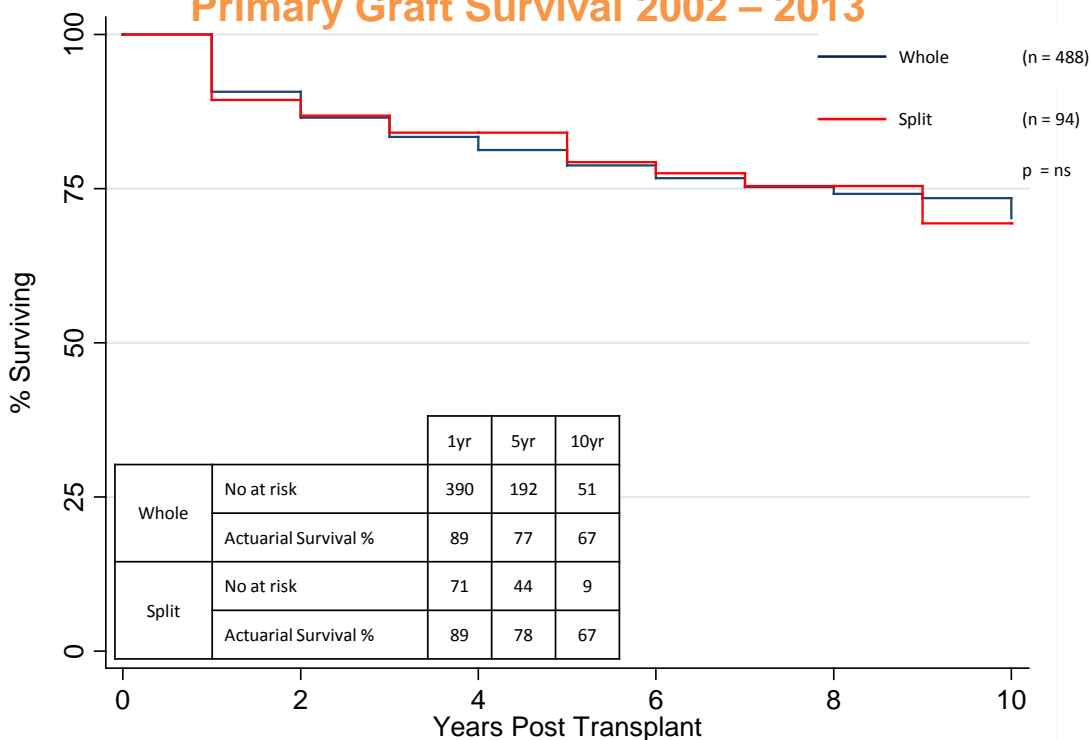
## Primary Graft Survival by Era Children



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Data to 31 December 2013

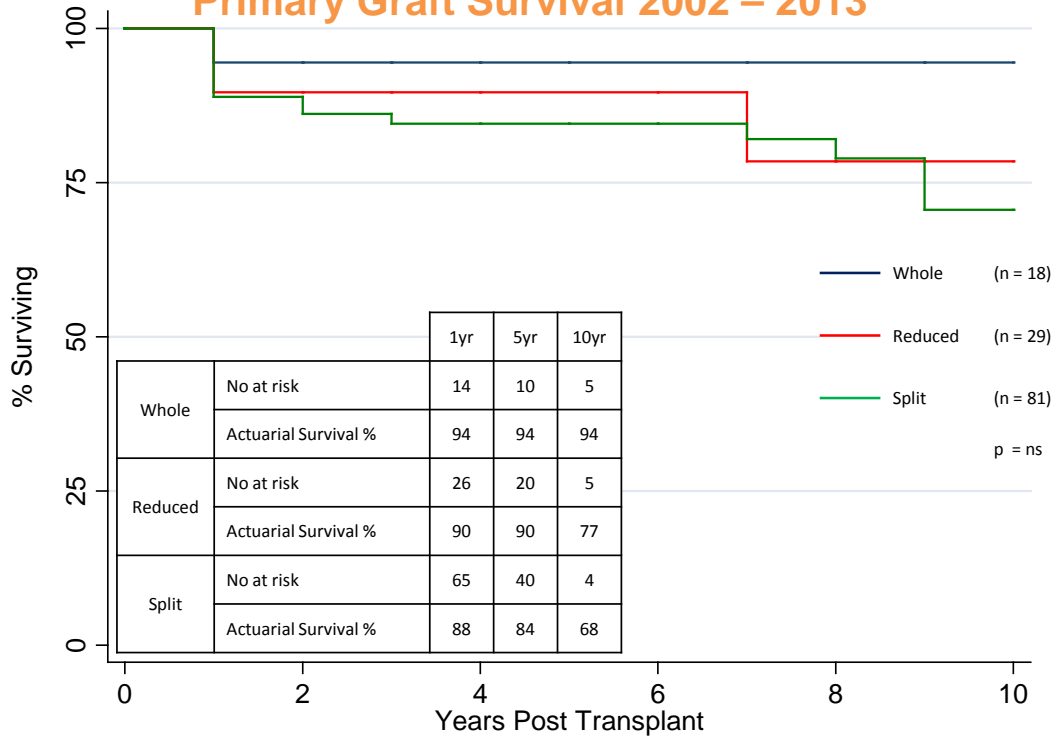
## Split vs Whole Grafts (Adults) Primary Graft Survival 2002 – 2013



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Data to 31 December 2013

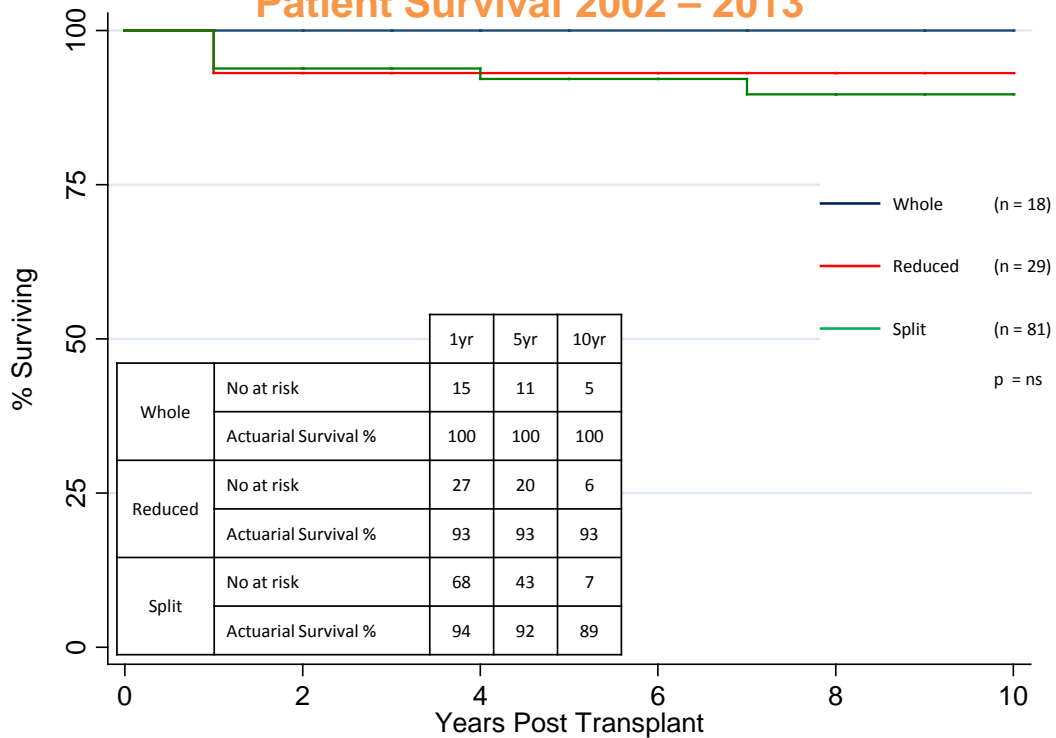
## Split vs Reduced vs Whole Grafts (Children) Primary Graft Survival 2002 – 2013



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Data to 31 December 2013

## Split vs Reduced vs Whole Grafts (Children) Patient Survival 2002 – 2013



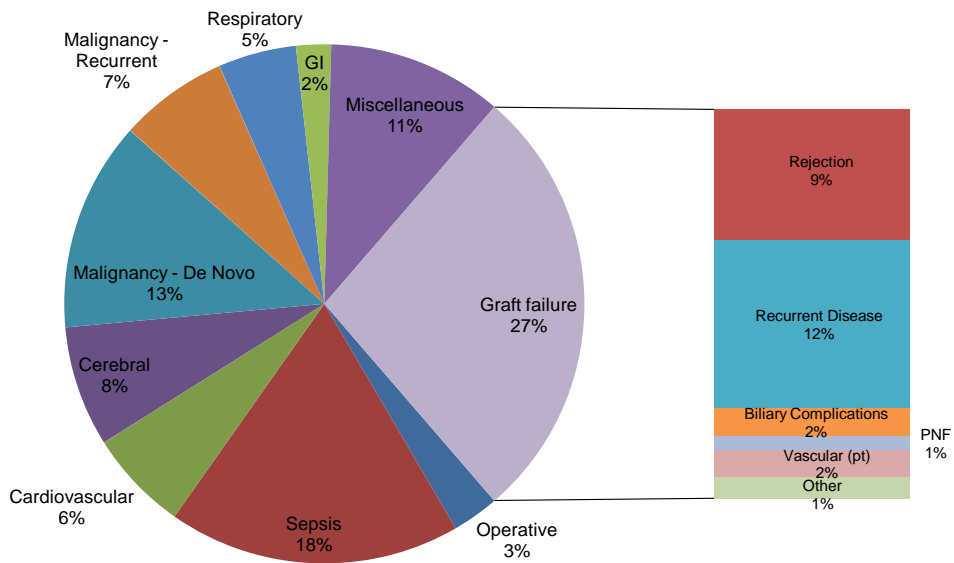
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Data to 31 December 2013

## Cause of Death

<b>Graft Failure</b>	113 (27.4%)
Rejection: Chronic	28
Rejection: Acute	10
Recurrent disease	
Hepatitis C	35
Hepatitis B	11
Vascular	8
Biliary Complications	8
PNF	4
NASH	2
Other	7
<b>Sepsis</b>	76 (18.4%)
<b>Malignancy</b>	81 (19.6%)
Recurrent disease	27
De Novo	53
Transferred from donor	1
<b>Cerebral</b>	31 (7.5%)
<b>Cardiovascular</b>	26 (6.3%)
<b>Respiratory</b>	20 (4.8%)
<b>Operative</b>	12 (2.9 %)
<b>Gastrointestinal</b>	9 (2.2%)
<b>Multi-organ Failure</b>	9 (2.2%)
<b>Vascular</b>	5 (1.2%)
<b>GVHD</b>	4 (1.0%)
<b>Renal Failure</b>	4 (1.0%)
<b>Other</b>	23 (5.6%)
<b>TOTAL</b>	413 (32.3% of all patients)

### Cause of Death (n = 413)



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Data to 31 December 2013

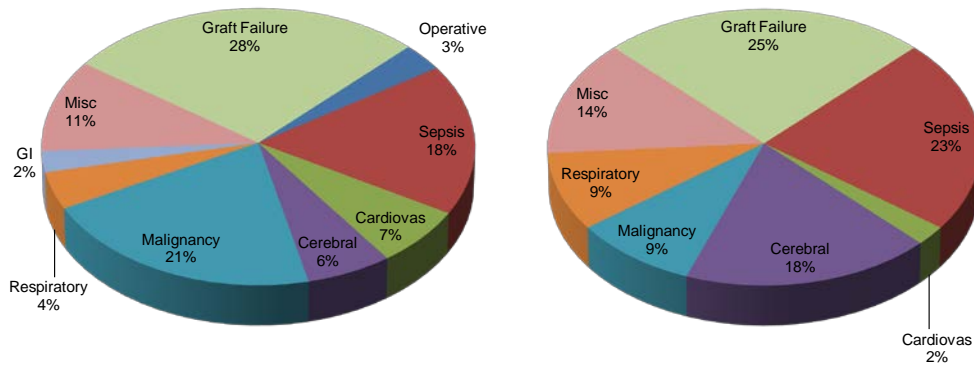
413 patients, or 32.3% of all patients transplanted, have died. Of these, 75 (18.2%) have died due to sepsis and 113 (27.4%) from graft failure.

Of the 113 cases of death due to graft failure, 38 (33.6%) patients lost grafts due to rejection, 49 (43.4%) from recurrent disease and 4 (3.5%) from primary non function (PNF).

### Cause of Death (n = 413)

Adults (n = 369)

Children (n = 44)

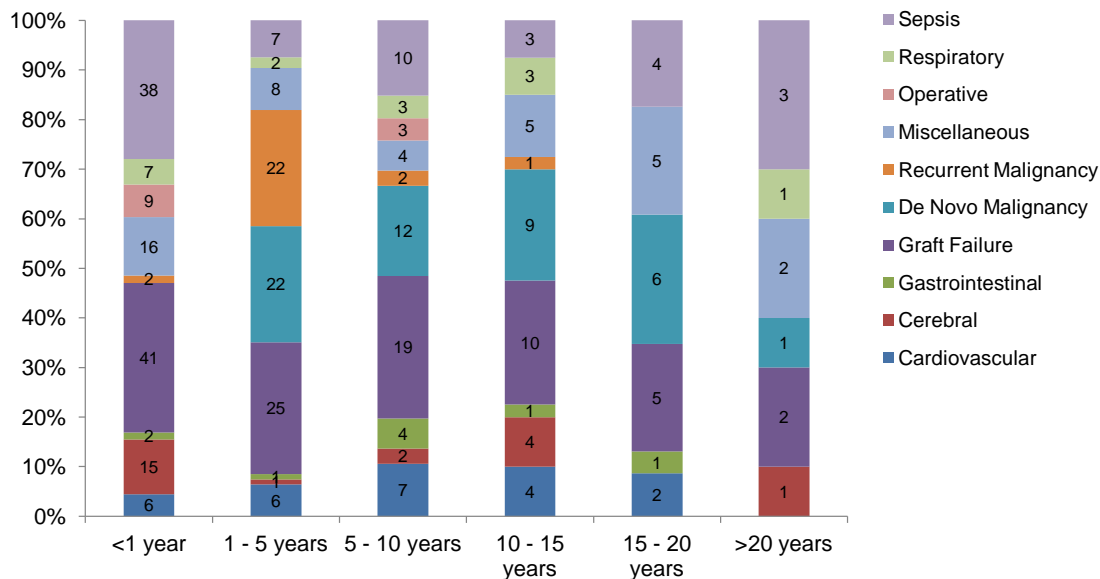


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Data to 31 December 2013

The majority of adult deaths were due to Graft Failure (102 or 27.6%), Sepsis (65 or 17.6%) and Malignancy (77 or 20.9%). The majority of child deaths were due to Graft Failure (11 or 25.0%), Sepsis (10 or 22.7%) and Cerebrovascular accident (8 or 18.2%).

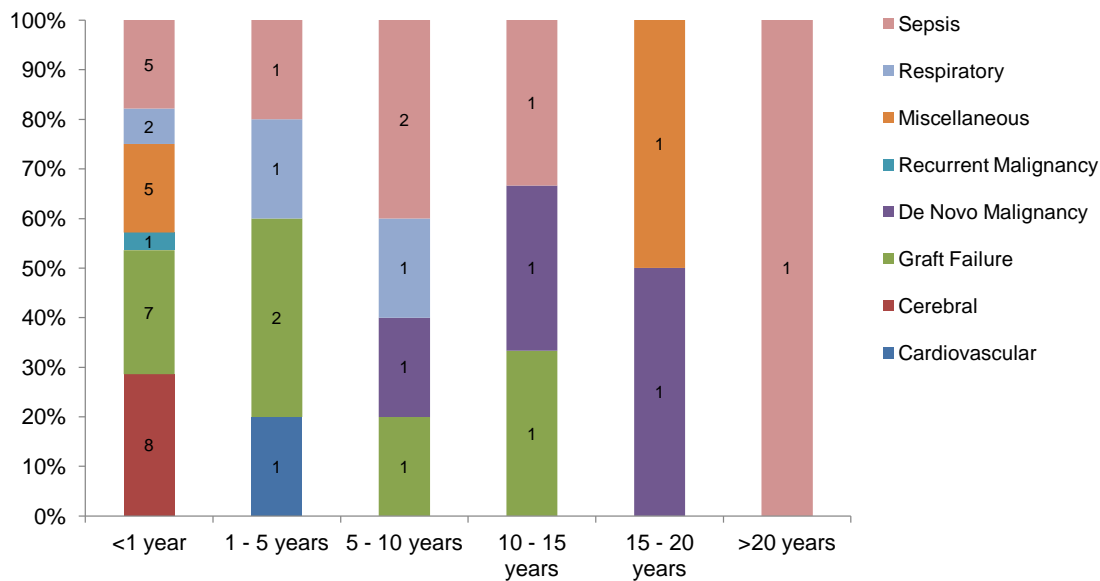
### Cause of Death by Time - Adults (n = 369; 35.4% of adults)



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Data to 31 December 2013

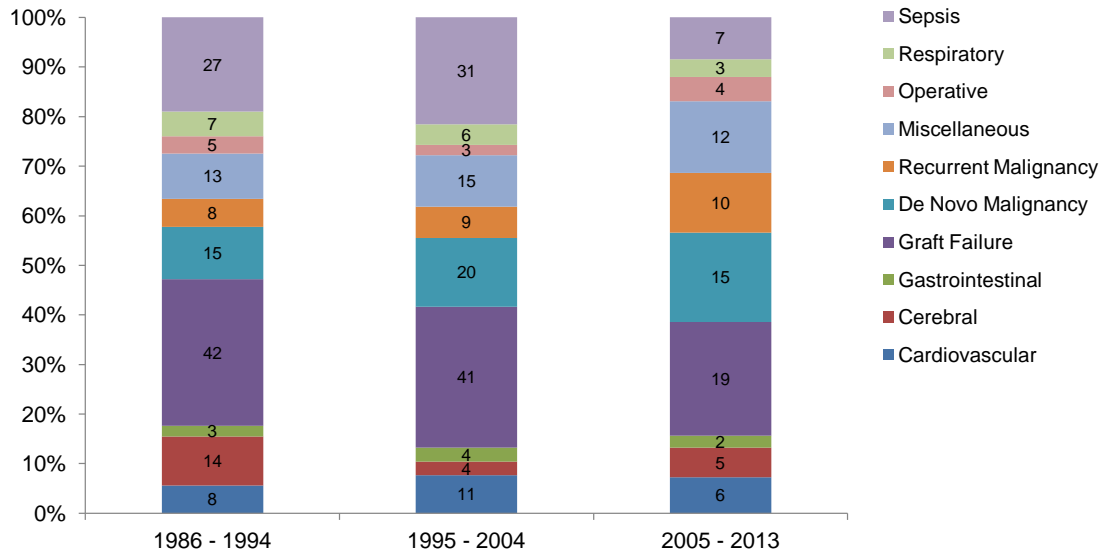
### Cause of Death by Time - Children (n = 44; 18.7% of children)



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Data to 31 December 2013

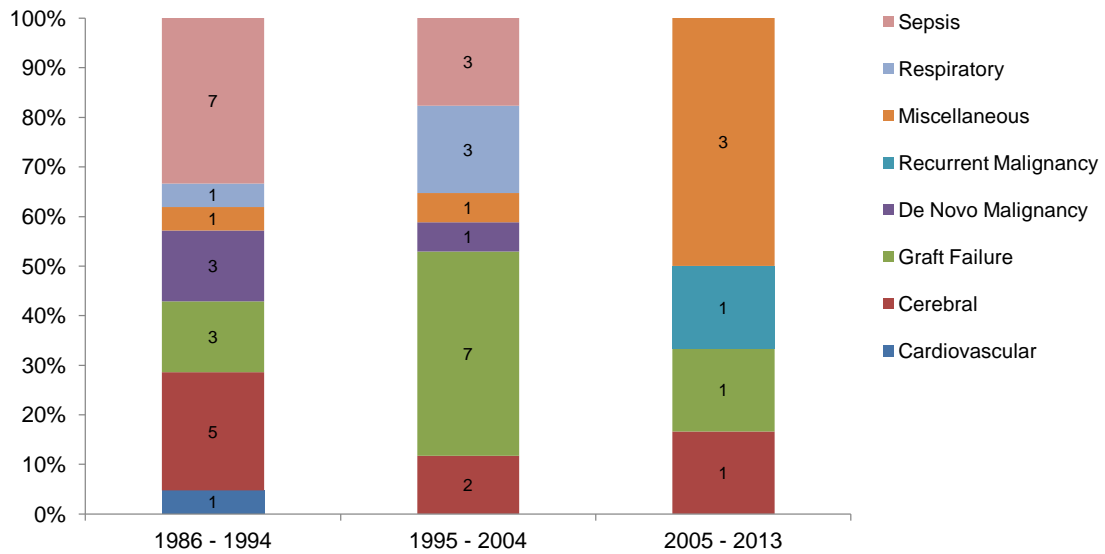
## Cause of Death by Transplant Era - Adults (n = 369; 35.4% of adults)



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Data to 31 December 2013

## Cause of Death by Transplant Era - Children (n = 44; 18.7% of children)

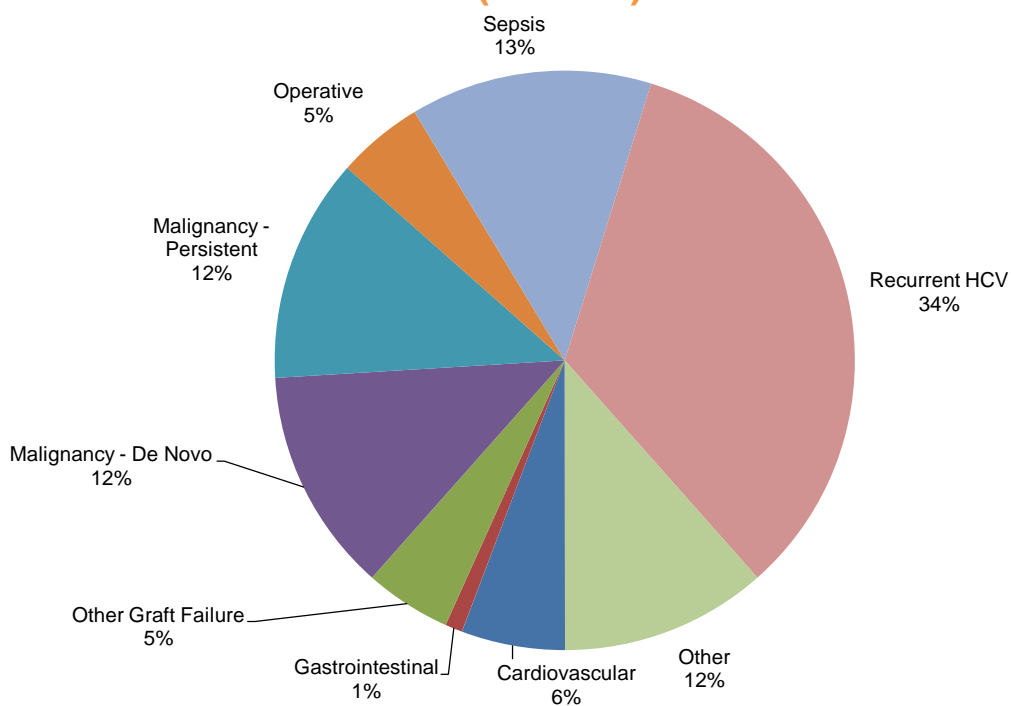


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Data to 31 December 2013



## Cause of Death – HCV Recipients (n = 104)



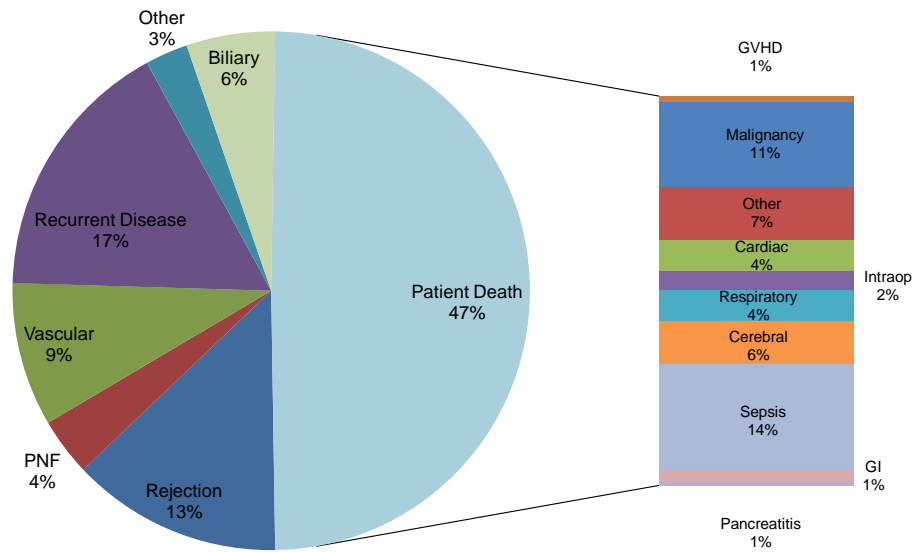
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Data to 31 December 2013

## Cause of Graft Failure

Rejection		69 (13.1%)
	Acute	17
	Chronic	45
	ABO incompatibility	6
	Subacute	1
Vascular complications		47 (9.0%)
	Hepatic artery thrombosis	36
	Portal vein thrombosis	4
	Graft infarction	2
	Dissection in donor	1
	Graft compression	1
	Hepatic vein stenosis	1
	Rupture	1
	Vena Cava obstruction	1
Recurrent disease		87 (16.6%)
	Hep C	43
	Malignancy	24
	Hep B	13
	NASH	2
	PSC	3
	Alcohol	1
Primary non function		19 (3.6%)
	Graft infarction	6
	Severe steatosis	4
	Antibody mediated rejection	1
	Arterial thrombosis	1
	Blood loss	1
	HA occlusion	1
	Preservation injury	1
	Profound hypotension	1
	Vena	1
	Other	2
Patient deaths		260 (49.5%)
	Sepsis	71
	Malignancy	57
	Cerebral	29
	Cardiovascular	21
	Respiratory failure	20
	Intraoperative	13
	GI haemorrhage	7
	GVHD	4
	Pancreatitis	3
	Other	35
Biliary complications		29 (5.5%)
	Biliary strictures	20
	Other	9
Other		14 (2.7%)
<b>TOTAL</b>		<b>525 (35.4%) of all grafts</b>

### Cause of Graft Failure (n = 525)



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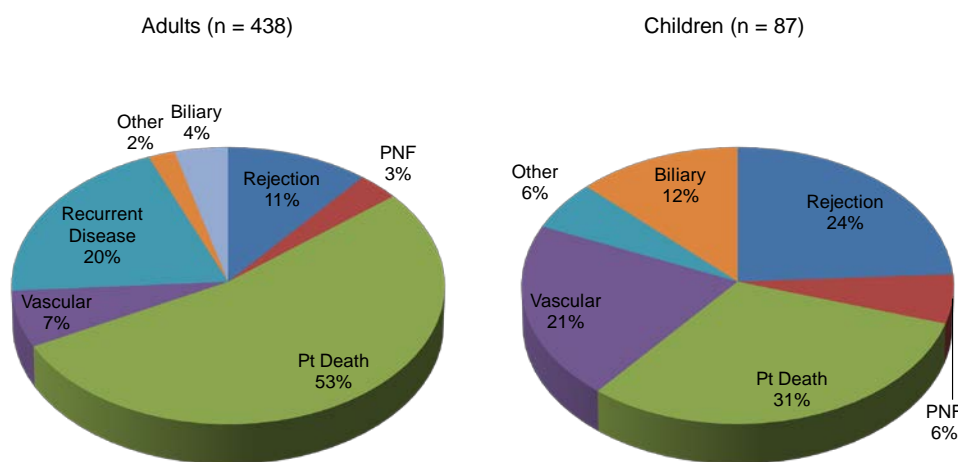
Data to 31 December 2013

525 of 1388 grafts (37.8%) have failed.

260 grafts (49.5%) were lost due to patient deaths, 69 (13.1%) due to rejection and 87 (16.6%) due to disease recurrence.

Sepsis was the most significant cause of patient death (68 patients), followed by malignancy (56 patients) and cerebral catastrophe (30 patients).

### Cause of Graft Failure (n = 525)

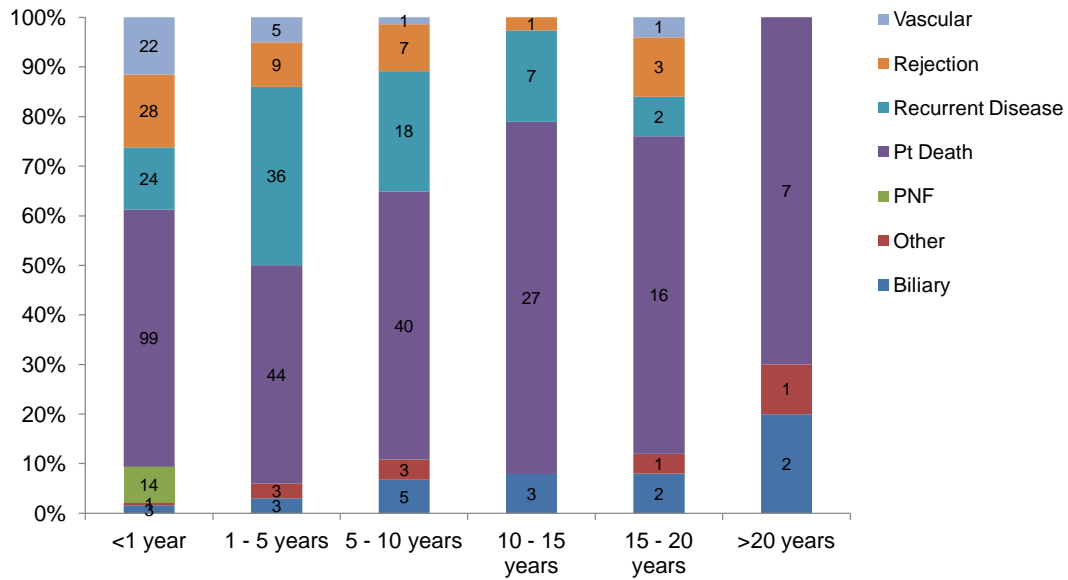


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Data to 31 December 2013

Patient death was the most significant cause of graft failure, followed by rejection.

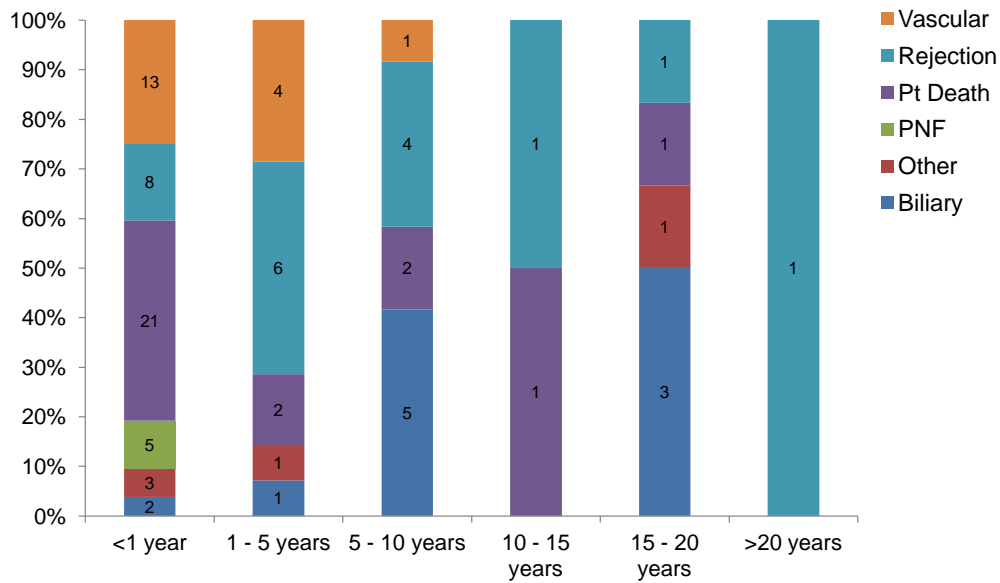
## Cause of Graft Failure by Time - Adults (n = 438; 39.3% of adult grafts)



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Data to 31 December 2013

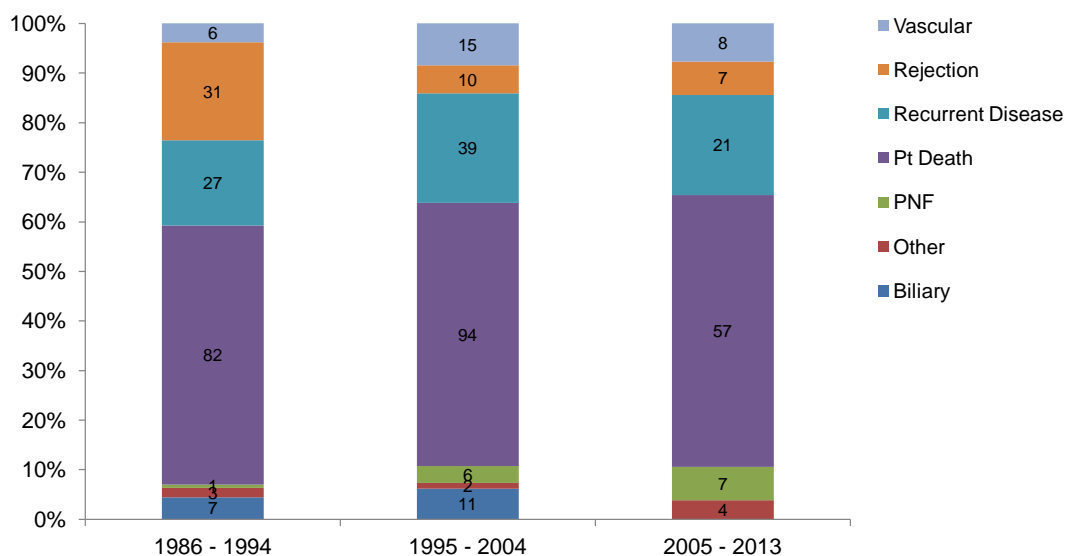
## Cause of Graft Failure by Time - Children (n = 87; 31.8% of child grafts)



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Data to 31 December 2013

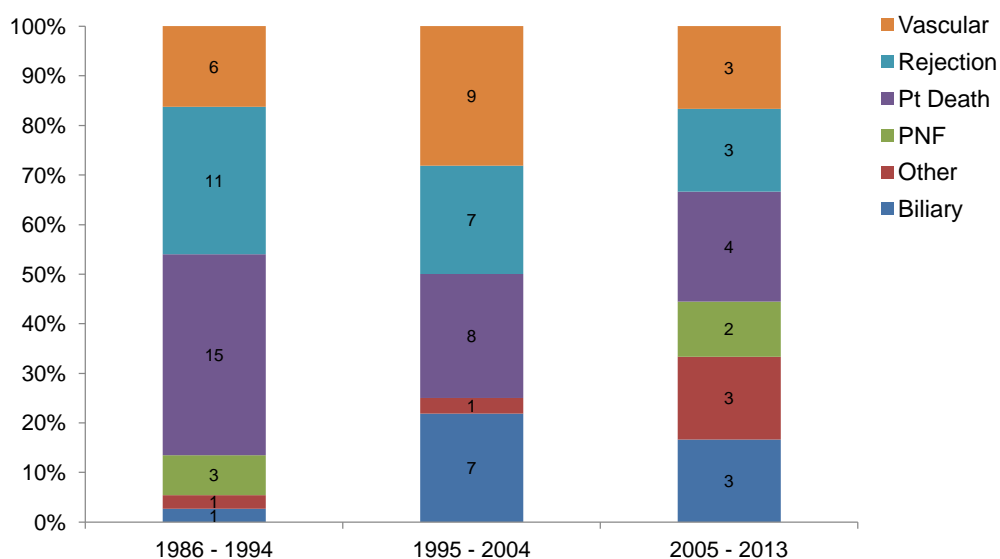
## Cause of Graft Failure by Transplant Era - Adults (n = 438; 39.3% of adult grafts)



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Data to 31 December 2013

## Cause of Graft Failure by Transplant Era - Children (n = 87; 31.8% of child grafts)



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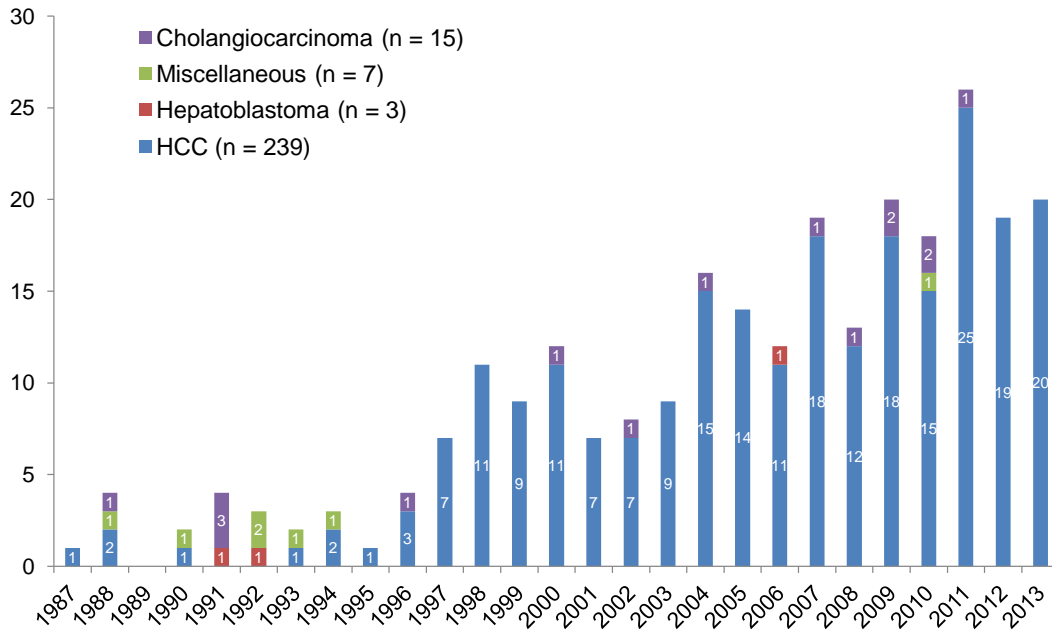
Data to 31 December 2013



# CANCER AND TRANSPLANTATION

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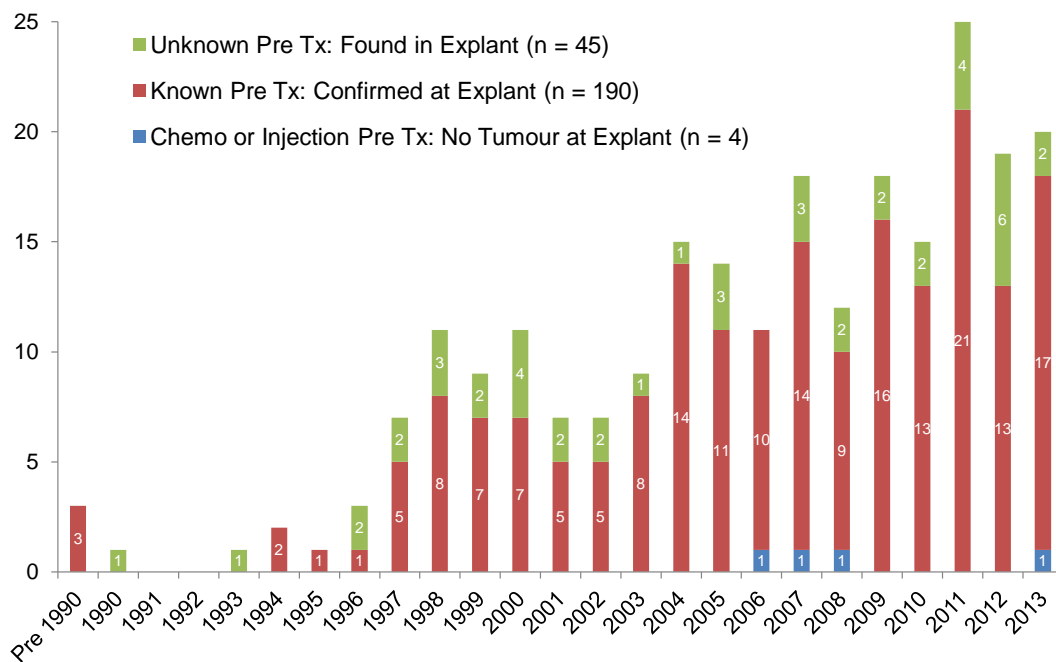
## Malignancy at Transplantation (n = 261 Pts/264 Ca; 20.4% of patients)



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## HCC at Transplantation (n = 239)



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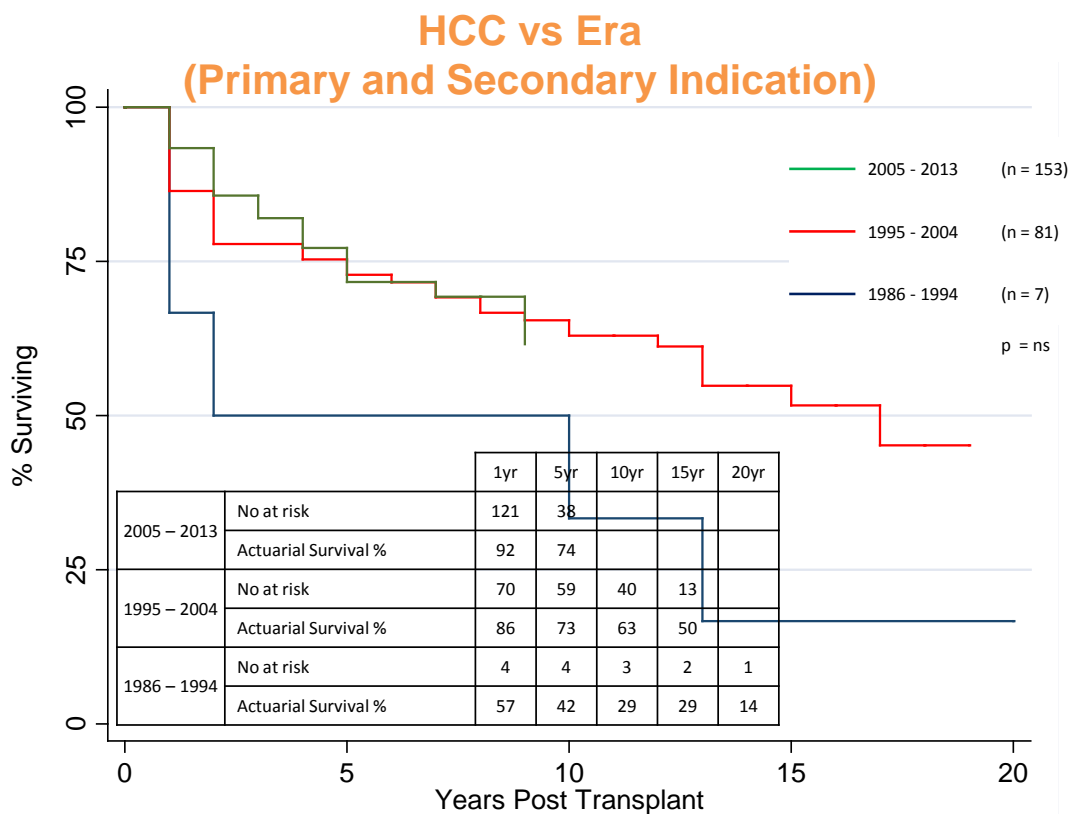


## Cancer in Liver Transplant Recipients 1986 - 2013

At Transplant (1278 patients)		Patients (n,%)
Liver cancer as primary diagnosis		115 9%
Liver cancer as secondary diagnosis		138 11%
No. of Patients with a cancer diagnosis at transplant		253 20%
Post Transplant		
Recurrent liver cancer		33 2% of all pts, 13% of cancer at tx pts
De novo non-skin cancer		100 8% of all pts, 40% of cancer at tx pts
De novo skin cancer		197 15% of all pts, 78% of cancer at tx pts
No. of Patients with a post transplant cancer		330 26% of all pts
Patients with multiple cancers		139 10% of all pts
Pre transplant cancer developed de novo cancer		56 22% of cancer at tx pts
Transferred from donor		4
Developed non-skin cancer within 90 days		1

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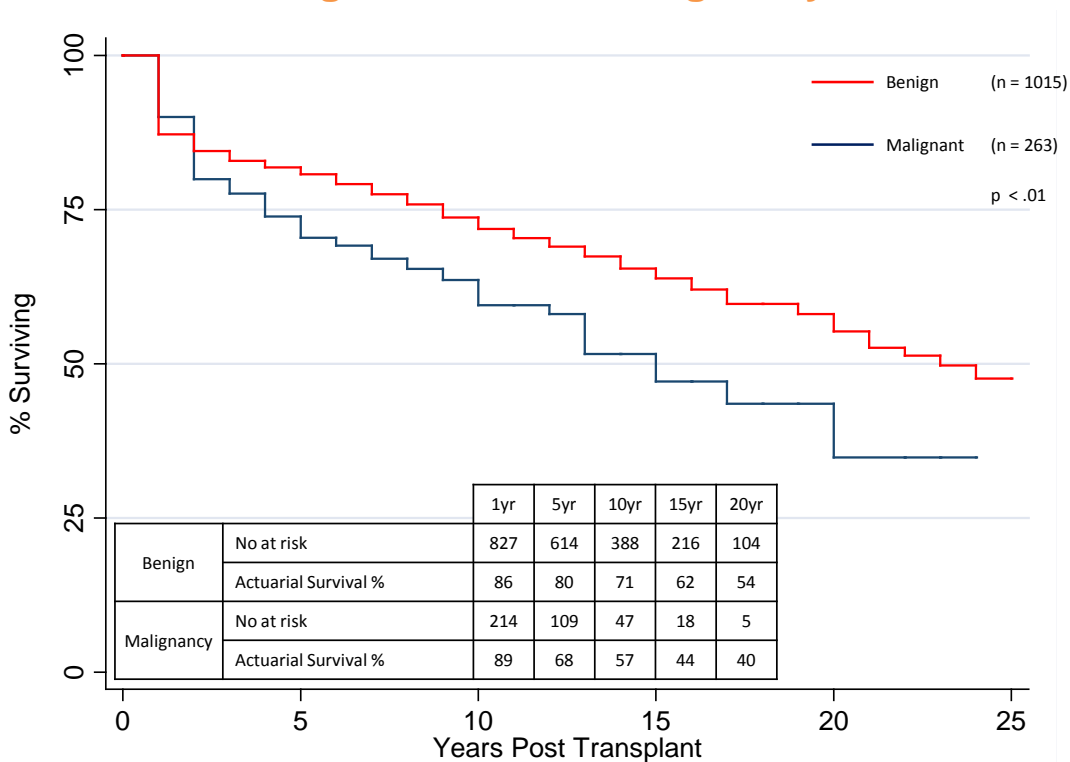
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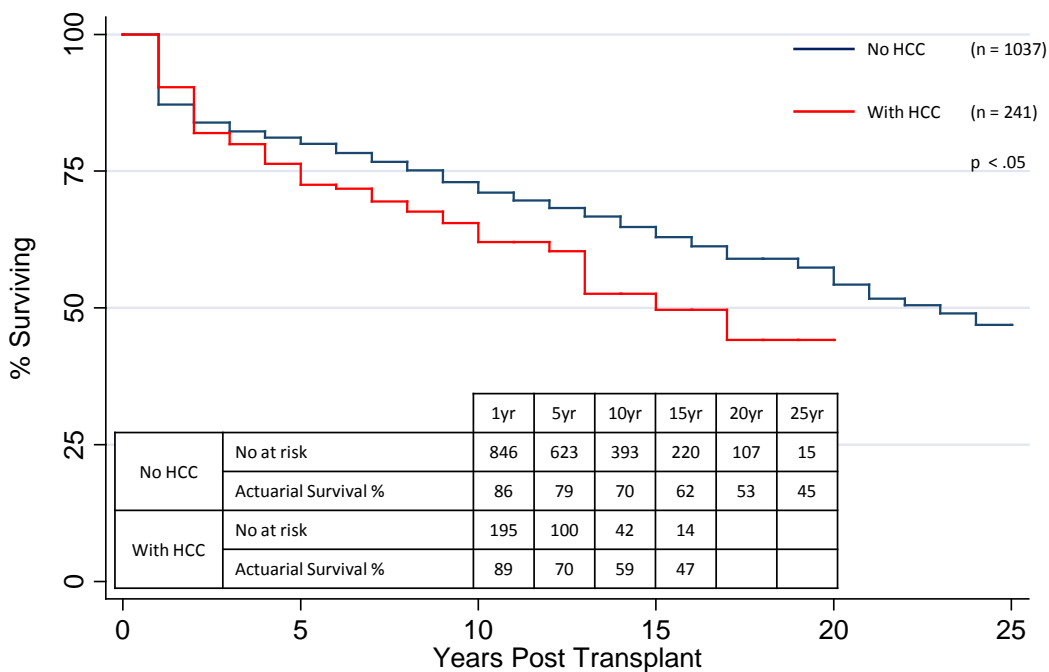
## Benign Disease vs Malignancy



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## Primary and Secondary HCC vs No HCC



— No HCC    — Primary and Secondary HCC

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## De Novo Cancer (Excluding Skin)

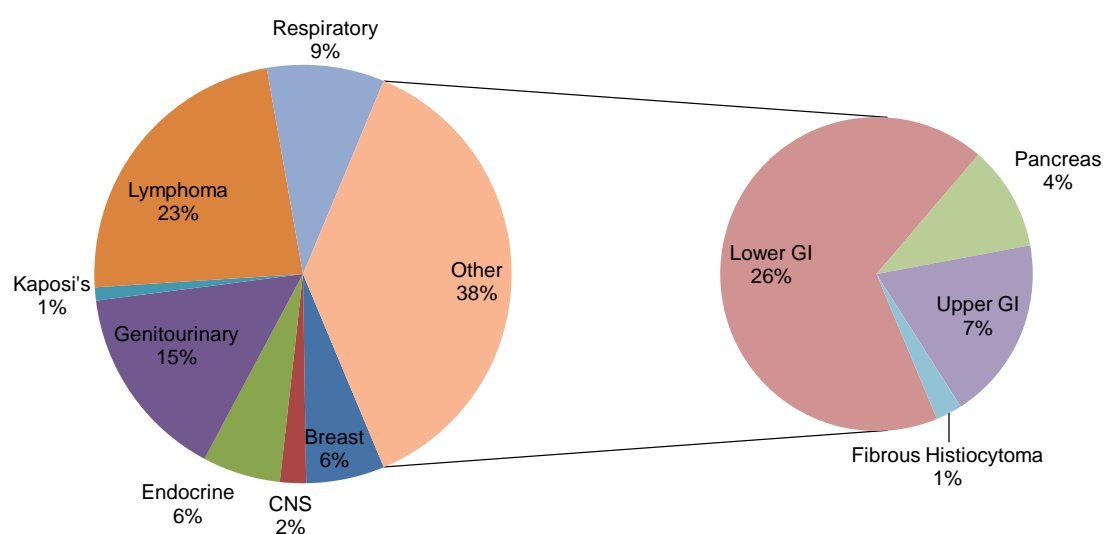
	No	Male	Female	Age of patients (years)	Time to diagnosis (months)	Died of This Cancer		Died Other
Alimentary	42	32	10	13 - 78 (m = 58)	6 - 261 (m = 74)	22	52%	6
Lymphoma (including PTLT)	23	14	9	1.5 - 70 (m = 44)	4 - 218 (m = 87)	7	30%	5
Genitourinary	15	12	3	21 - 74 (m = 59)	2 - 229 (m = 83)	2	13%	4
Respiratory	9	7	2	29 - 68 (m = 61)	7 - 194 (m = 34)	8	89%	0
Breast	6	0	6	30 - 60 (m = 45)	50 - 241 (m = 115)	4	67%	1
Endocrine	6	2	4	36 - 70 (m = 56)	35 - 145 (m = 82)	2	33%	0
CNS	2	1	1	66 - 75 (m = 70)	14 - 93 (m = 53)	2	100%	0
Fibrous Histiocytoma	1	0	1	62	120	0		0
Kaposi's	1	1	0	32	48	0		1
<b>Total</b>	<b>105</b>	<b>69</b>	<b>36</b>	<b>1.5 - 78 (m = 62)</b>	<b>2 - 261 (m = 120)</b>	<b>47</b>	<b>45%</b>	<b>17</b>

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NB: m = median

Data to 31 December 2013

## De Novo Cancer (Excluding Skin) (n = 99 Pts, 105 Ca; 7.7% pts transplanted)

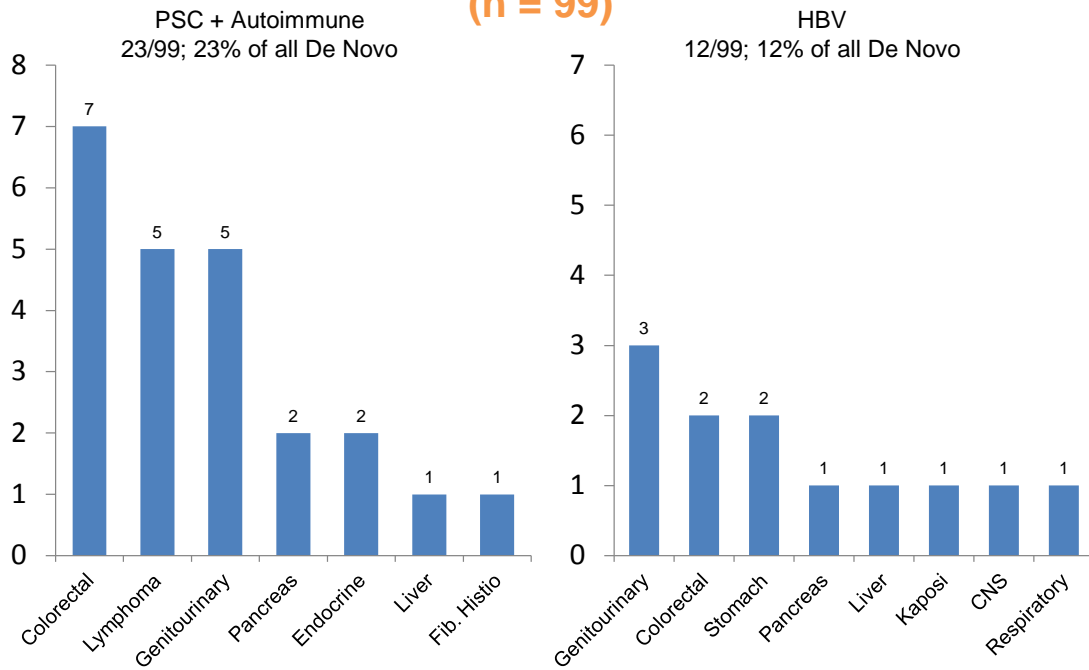


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## Pre Transplant Liver Disease and De Novo Cancer (Excluding Skin)

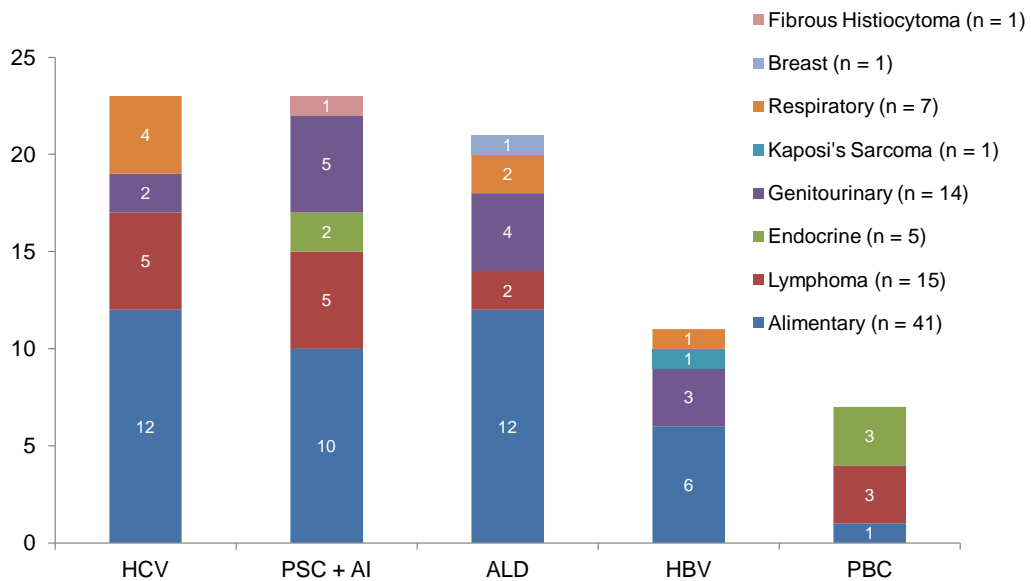
(n = 99)



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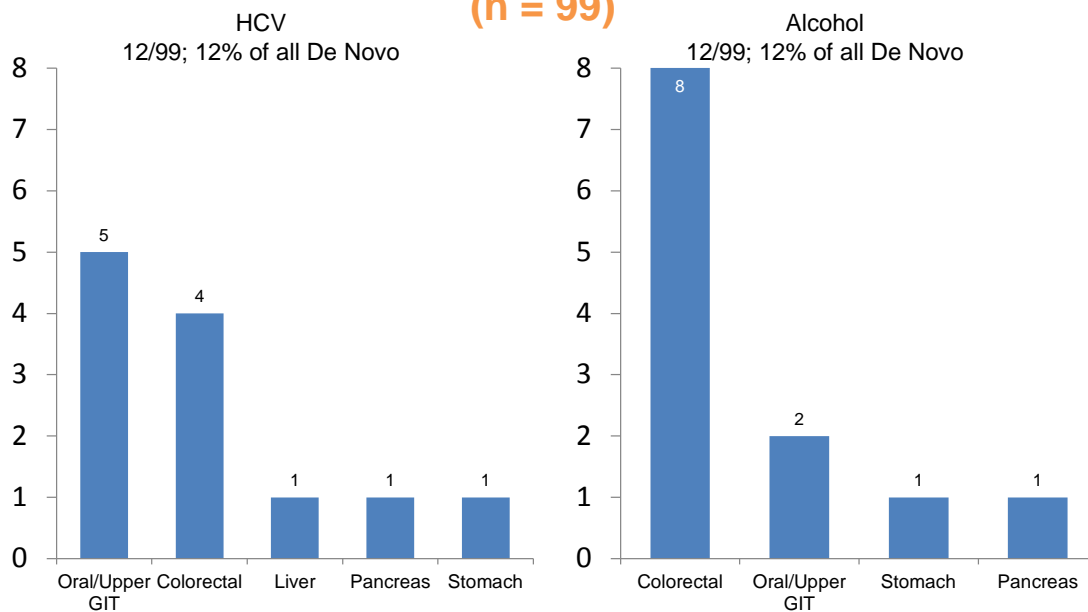
## Primary Liver Disease and De Novo Cancer (Excluding Skin)



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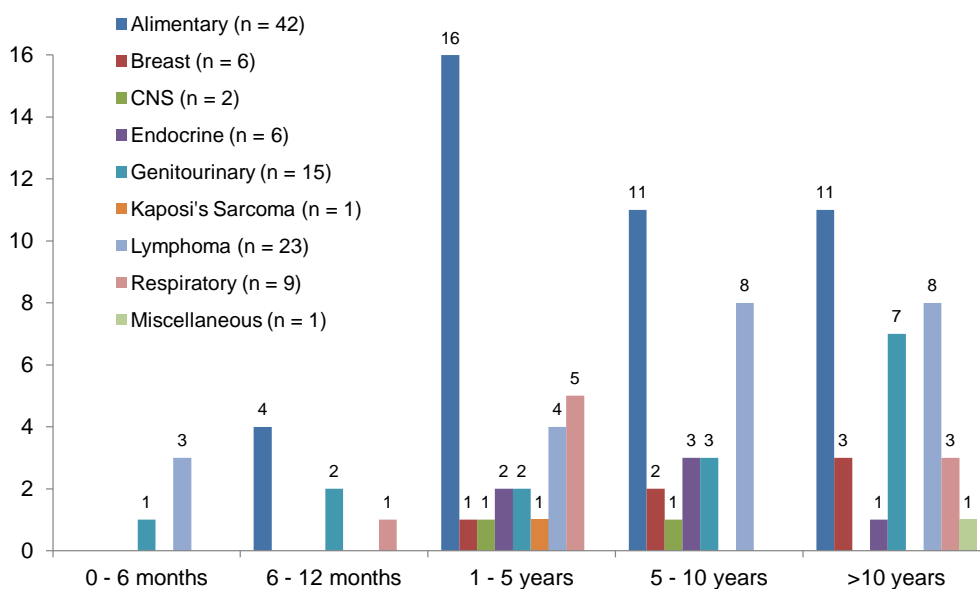
## Pre Transplant Liver Disease and De Novo Cancer (Excluding Skin) (n = 99)



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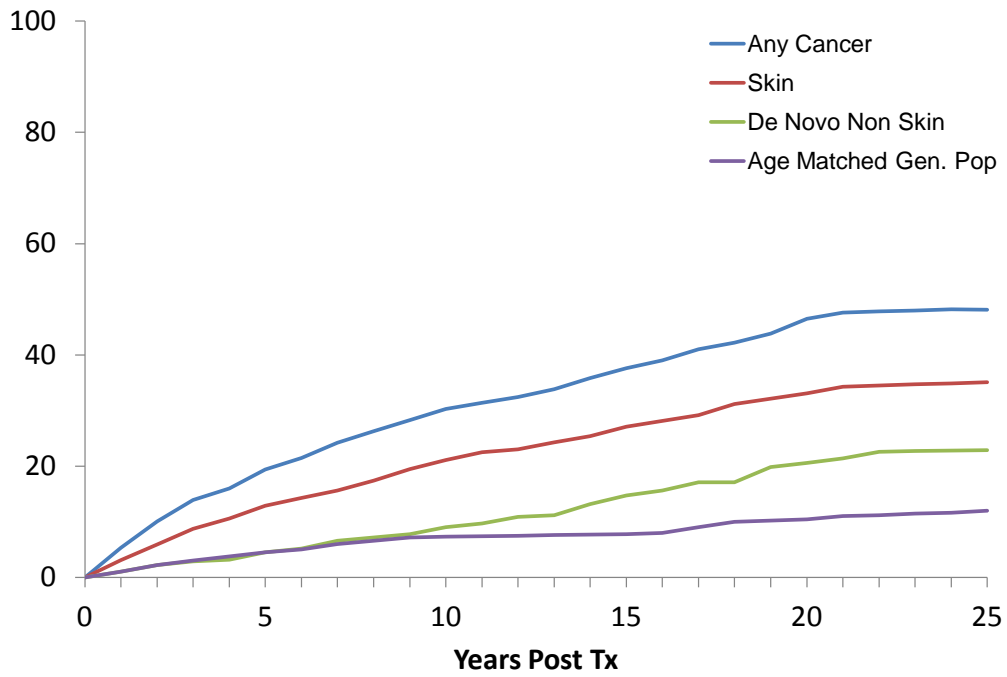
## Time to Diagnosis De Novo Cancer (Excluding Skin)



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## Cumulative Risk of Diagnosis of Cancer Following Liver Transplantation 1986 – 2013



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