

# AUSTRALIA & NEW ZEALAND



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## LIVER TRANSPLANT REGISTRY



From the Combined Registries  
of the Australian and New Zealand  
Liver Transplant Centres

DATA TO 31-12-2010

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## CITATION

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Editors: S.V. Lynch, G.A. Balderson

## STATISTICAL METHODS

Kaplan-Meier survival curves have been produced using SPSS® for Windows™ Release 19.0, SPSS Inc.

## ACKNOWLEDGMENT

The Cancer Registry is maintained at Transplantation Services, Royal Prince Alfred Hospital, Sydney. Report prepared by Pamela Dilworth, Marie Mulhearn and Dr Deborah Verran.

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# Preface

We are pleased to present the 22nd Report of the Australia and New Zealand Liver Transplant Registry (ANZLTR). This report contains data to the 31st December 2010 and analyses the cumulative data since the establishment of the first liver transplantation unit in Australia or New Zealand in 1985. There are several changes of note in this Report. Children are now defined as < 16 years and several data tables and diagrams covering graft outcome, retransplantation and causes of death have been expanded to show adult and paediatric results separately as opposed to combined numbers in previous reports.

The Australia and New Zealand Liver Transplant Registry (ANZLTR) is a collaborative effort of the liver transplantation centres in Australia (Adelaide, Brisbane, Melbourne, Perth, Sydney) and New Zealand (Auckland). The Registry is supervised by the Management Committee which is involved in the ongoing supervision of the development of the Registry. The members of the Management Committee are listed on the front page.

Donor data have been supplied by the Australia and New Zealand Organ Donor Registry and we thank them for their collaboration.

The Editors would also like to thank the staff of all the Liver Transplant Units who contribute their data by direct entry into the ANZLTR database. A full list of the Units and their contact information can be found in Appendix I. In particular we are grateful to the efforts of Pamela Dilworth, Program Manager and Marie Mulhearn for their continuing contribution to the maintenance of the Cancer Registry which is based at the Royal Prince Alfred Hospital, Sydney and who, together with Dr Deborah Verran, prepare the Cancer Report.

The registry has financial support and we are grateful to the Australian Government, through the Australian Organ and Tissue Authority, for their financial contribution.

Some additional funds are received from Janssen-Cilag Pty Ltd and Novartis Pharmaceuticals Australia Pty Ltd on an ad hoc basis.

Comments are always welcome and should be forwarded to the Coordinating Centre at the contact information listed on the front page as should requests for further copies of this Report. The report is now also available on the ANZLTR public web site [www.anzltr.org](http://www.anzltr.org) from where the report can be downloaded. Slides are available on request from the Coordinating Centre.

Stephen Lynch  
Glenda Balderson





# Summary

## Page

5. Between January 1985 and 31st December 2010, 3781 orthotopic liver transplants (OLT) were performed in Australia and New Zealand on 3510 patients, 2871 adult patients [82%] and 639 children (< 16 years) [18%]. The median age of all recipients was 47 years. The ages ranged from 24 days to 73.1 years. There is a significant difference in gender distribution between children (M=47%) and adults (M=64%)
6. Two hundred and thirty three new patients were transplanted in 2010 compared with 211 in 2009.
7. The trend to increasing age of adult recipients in recent years continued and the overall adult median age is now 49.9 years. The median age of new adult recipients in 2010 was 53.9 years.
- 8-9. In 2010, 20 more transplants were performed then in 2009 [248 vs 228]. Split grafts continue to make a significant contribution to the total number of paediatric transplants performed providing 18 of 46 [39%] grafts in 2010 and 162 of 731 [22%] overall. In children, other reduced size grafts have been used in 336 [46%] cases including 49 living donor grafts. One child has been treated with liver cell implantation. Of adult patients, 206 have received reduced size grafts - 168 split liver grafts (including 1 as auxiliary graft), 28 other reduced size grafts (1 as auxiliary graft) and 10 living donor grafts. One domino transplant of a whole liver has been performed.
- 10-11 Overall, chronic viral hepatitis (CVH) is the most common primary indication for liver transplantation. In children biliary atresia (BA) is the most common primary disease. In adults chronic hepatitis C [CVH : HCV] is the primary disease in 21% of recipients and chronic hepatitis B [CVH : HBV] in 7 %. Full details of specific diagnoses categories by age group are listed in the Appendices for - Metabolic disorders (Appendix II), Other diseases (Appendix III), Fulminant Hepatic Failure (Appendix IV).
- 12-15. The number of patients transplanted for non alcoholic fatty liver disease [NAFLD/NASH] continued to increase with 12 new patients transplanted in 2010 bringing the total to 58. While the total number of adult patients transplanted with a primary diagnosis of chronic viral Hepatitis B, C or B/C/D fell slightly in 2010 compared with the previous era [30% primary diagnosis CVH], the number with a primary diagnosis of hepatocellular carcinoma [HCC] rose to 14% with the majority of these patients having a secondary diagnosis of CVH. When patients with either primary or secondary diagnosis of Hepatitis B, C or both are included, the overall incidence of CVH in new adult patients in 2010 was 40%.
16. Overall 1 year patient survival of all patients is 88% at 1 year, 80% at 5 years and 72% at 10 years. Children have a significantly better survival rate then adults with an actuarial survival of 71% at 25 years post-transplant.
17. Whilst older children had superior early survival then infants and babies, long term survival is similar. Older adult recipients (60-65 and >65 years) had poorer longer term outcomes.
- 18-19. Patient survival in 2000-04 cohort shows continued improvement in outcome for the first 10 years compared with earlier cohorts. This is seen in both children and adults. One year patient survival in 2005-09 cohort was 93% for all patients [94% for children, 92% for adults].
20. The type of primary deceased donor graft, (whole, reduced or split liver), had no significant effect on patient survival in children. Reduced grafts in adults had worse outcomes then whole or split-liver grafts.



# Summary

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21. Smaller children and babies weighing < 8 kg at the time of transplant had inferior early survival compared to heavier children.
22. Adult patients transplanted for biliary atresia or hepatitis virus co-infections had the best longer term survival while those whose primary disease was malignancy had a significantly lower survival rate. Longer term survival for patients transplanted for Hepatitis C was also lower.
23. In children, patient survival was similar for all disease groups though lower in patients whose primary disease was malignancy. There were no differences in survival between adults and children transplanted for fulminant hepatic failure [acute and sub-acute] with overall 5 year survival of 76%.
24. Recent cohorts of adult patients with a primary diagnosis of hepatitis B continue to show a significantly improved survival which is not seen in adult patients with hepatitis C as primary disease. Patients transplanted for malignancy continue to have a poor outcome but some improvement in longer term outcome is seen in patients transplanted since 2000.
- 25-26. Overall graft survival was 75% at 5 years. Survival was significantly worse in second and third grafts in both children and adults.
27. Overall split liver grafts have similar graft survival to whole liver grafts. Reduced grafts have lower survival in the early post-transplant years in both children and adults.
- 28-29. Vascular complications and rejection were the commonest indications for retransplantation. Eleven percent of retransplants were due to poor early graft function. Retransplantation for recurrent disease was most prevalent in adults [8% PSC, PBC, AIH and 9% HBV, HCV].
- 30-33. Sepsis is the most frequent cause of death in both adults and children. Full details of Miscellaneous and Other Graft Failure deaths are listed in Appendix V. Thirty-seven percent of all deaths occurred within 6 months of transplant. Early graft failure was due to poor or no early graft function. By 1 year malignancy and graft failure from recurrent disease or chronic rejection cause most deaths. Deaths due to de novo malignancy and chronic rejection are increasing with longer survival time.
34. There was an increase in the number of cadaveric donors in 2010 with 238 grafts transplanted from deceased donors. The number of livers split to produce two transplantable grafts increased slightly to 17 in 2010. Thirteen liver grafts donated after cardiac death were transplanted. The number of people on the waiting list at 31 December 2010 was higher than the number on the waiting list at 31 December in the previous years.
35. Donor age has increased significantly in recent years. Long term graft survival trends lower in several older donor age groups.
36. Sixty patients [49 children, 11 adults] have now received a living donor graft with 10 performed in 2010. Fifty-five were transplanted as a primary graft, 4 as second and 1 as a third graft. The median age of the donors was 34.2 years with a range of 22.8 to 54.5 years. One adult graft was a domino graft.



# Summary

## Page

37. The number of patients listed for transplantation increased slightly in 2010 and 194 patients remained on the waiting list at 31 December 2010. Patient delistings due to death, becoming too ill or tumour [HCC] progression accounted for 8% of all delistings while 248 [49%] were transplanted. Forty nine patients were listed as urgent in 2010 [19 Category 1 and 30 Category 2]. Fourteen [74%] of Category 1 and 28 [93%] of Category 2 patients had a positive outcome.
- 38-39. Median waiting times tended to be lower in 2010 in some blood groups. Blood group B patients had the longest waiting times.
40. Cancer in liver transplant recipients was analysed from two perspectives. Firstly, those who had a liver cancer diagnosis at the time of transplantation (as primary, secondary or incidental) and secondly those who developed a cancer post transplantation (de novo skin and de novo non skin cancer)  
Overall 624 patients [18%] were transplanted with a liver malignancy – 234 [7%] as a primary diagnosis and 390 [11%] with a secondary diagnosis or incidental tumour. Post transplant 112 [18%] of these patients developed a recurrent cancer while in 40 patients death was related to their initial liver cancer.
- 41-42. Longer term survival of patients with primary liver cancers is significantly poorer for patients with cholangiocarcinoma. There has been a marked increase in the number of patients being transplanted for primary malignancy in the patient cohort 2006-10.
- 43-45. Three hundred and ninety two patients [11%] had liver cancer as a secondary or incidental diagnosis with hepatocellular carcinoma the most common. Of these 45 (12%) died from their malignancy. Those with cholangiocarcinoma had significantly poorer survival.
- 45-46. Patient survival was significantly worse in the 624 patients [18%] with pre transplant liver malignancy compared with patients with benign liver disease.
- 46-47. Two hundred and thirty seven de novo non skin cancers developed in 222 patients [6%] including 31 patients who had a liver cancer at transplant. Twelve patients had more than one de novo non skin cancer. Ninety five [40%] of these 222 patients have died from their cancer. Cancers of the alimentary tract [78] and lymphoma [68] predominate.
- 48-49. Colon was the predominant site of alimentary tract cancers. The incidence of de novo non skin cancers varies according to pre transplant liver disease, with the incidence in patients with primary sclerosing cholangitis of de novo non skin malignancy being statistically significant ( $p < 0.0001$ ).
50. Four hundred and fifty five patients (13%) developed 3139 skin cancers with 221 patients having multiple skin cancer types and 21 developed melanoma.
51. The cumulative risk of diagnosis of any cancer post transplant is approaching 40% by 20 years.

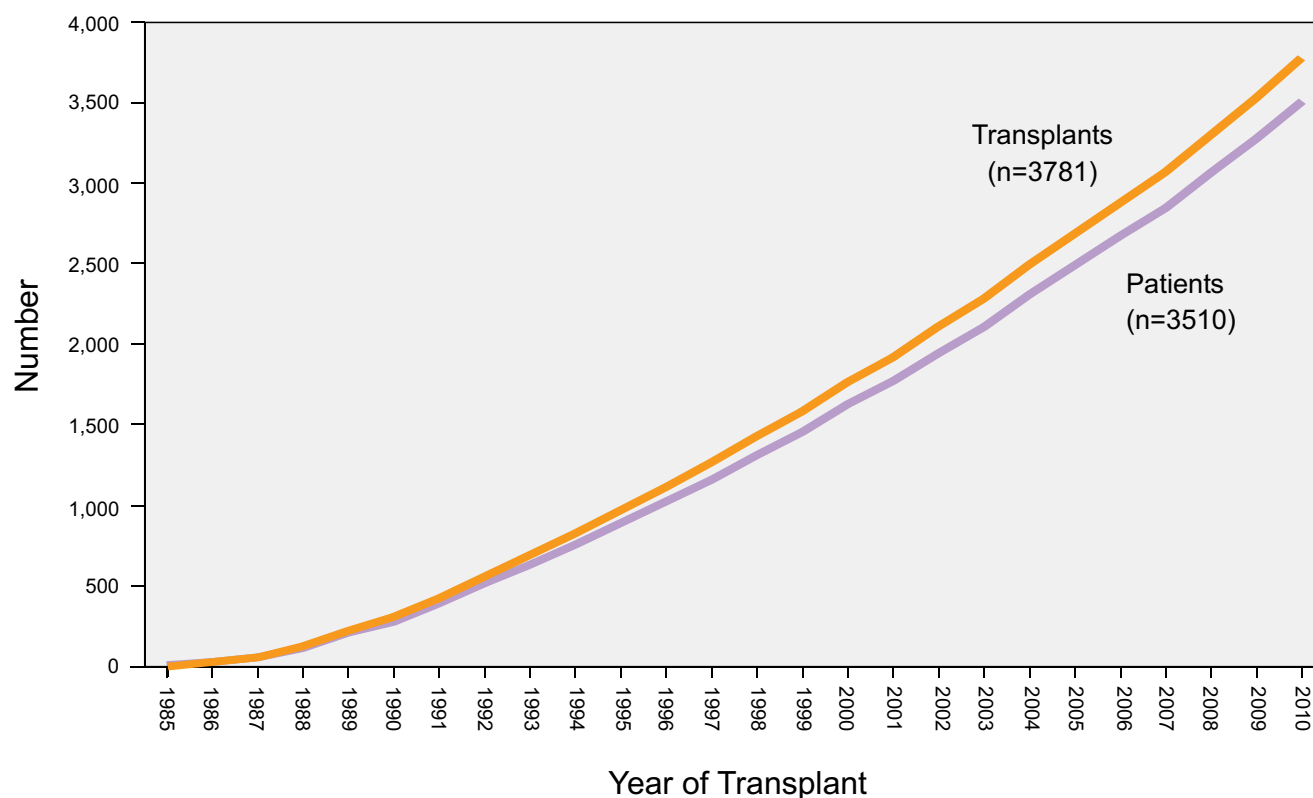


# Section 1

## Demographic Data



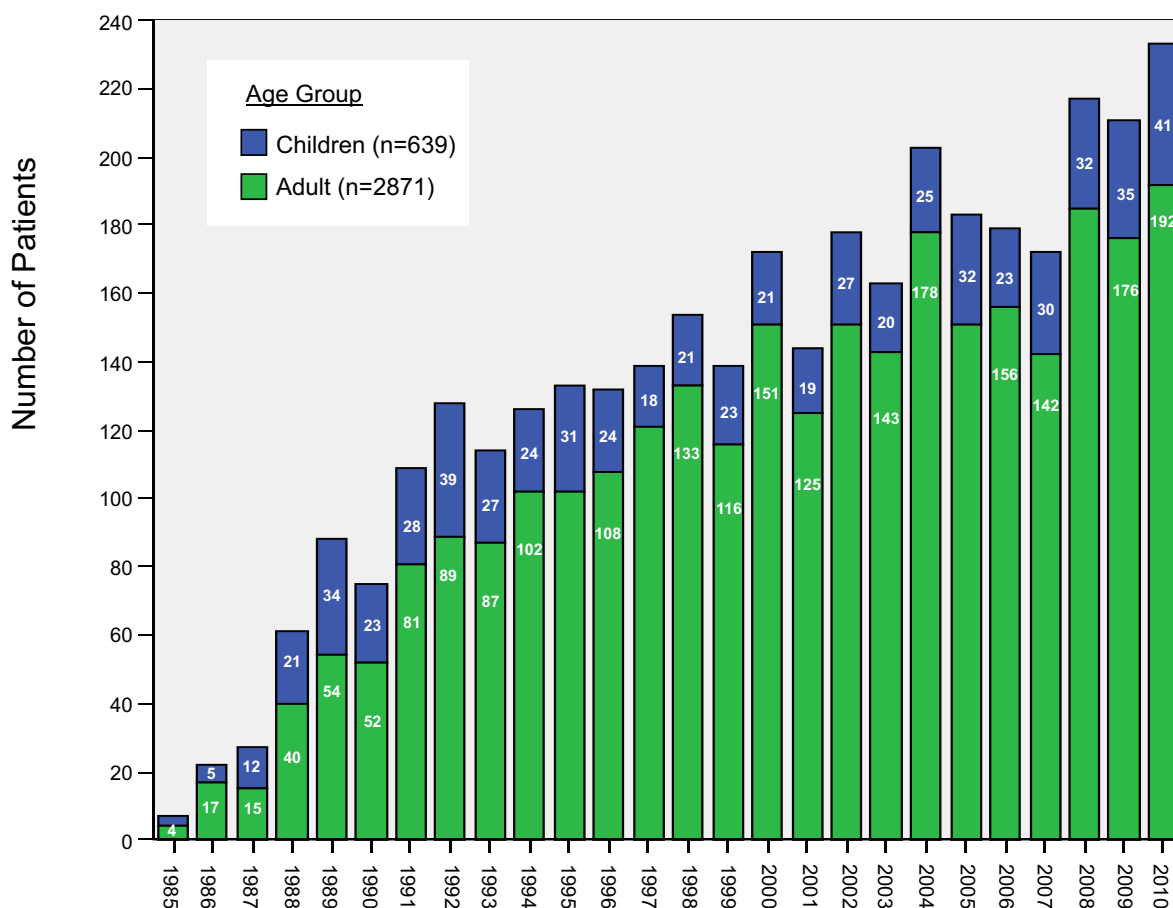




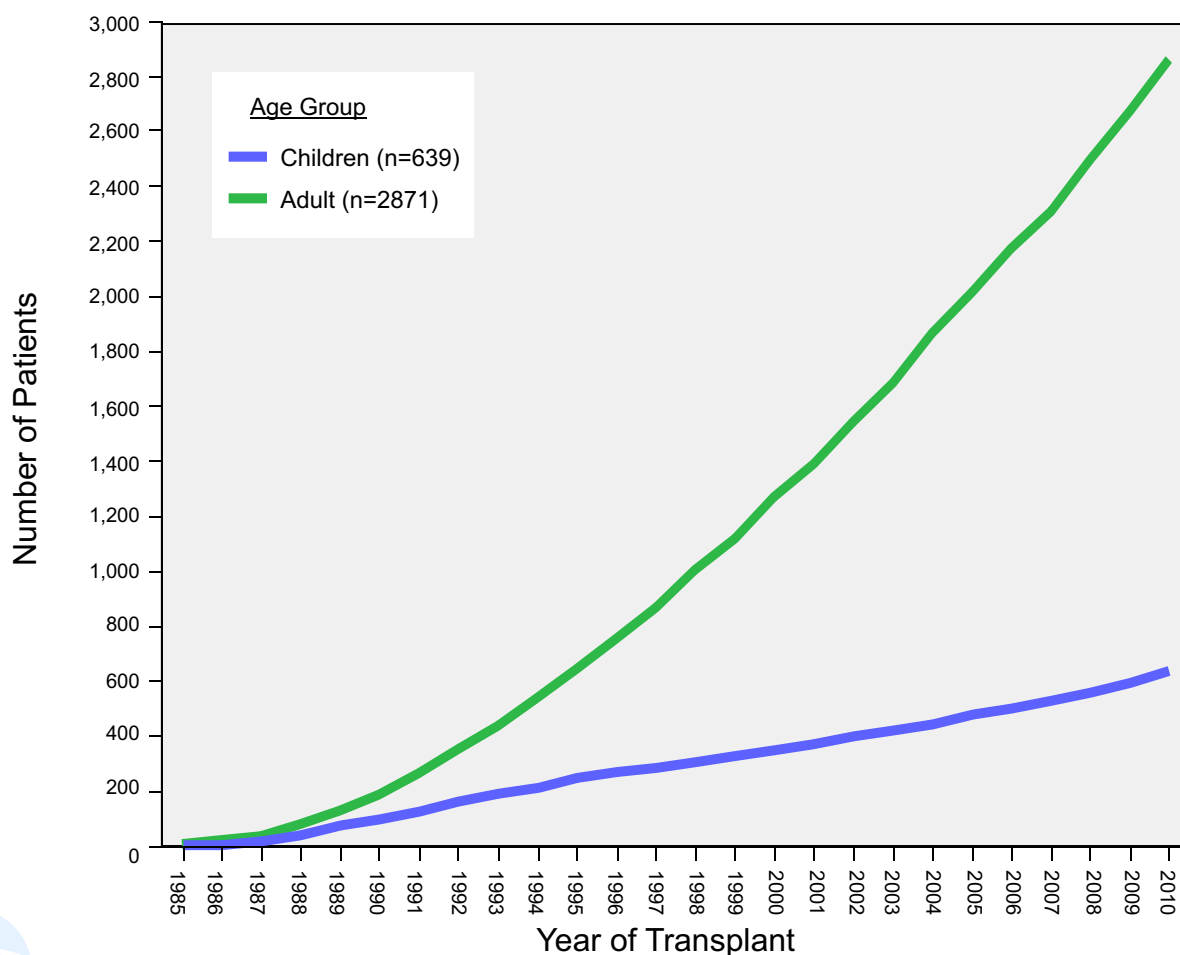
## Summary Statistics - Age and Gender

### ALL PATIENTS TRANSPLANTED

	Children [<16y]	Adults	Total
<b>Patients</b>	639	2871	3510
<b>Age</b>			
<i>Mean ± SD</i>	4.6 ± 4.5y	48.1 ± 11.6y	40.2 ± 19.9y
<i>Median</i>	2.5y	49.9y	47y
<i>Range</i>	24d -15.9y	16.0 - 73.1y	24d - 73.1y
<b>Gender</b>			
<i>Female</i>	339 (53%)	1039 (36%)	1378 (39%)
<i>Male</i>	300 (47%)	1832 (64%)	2132 (61%)
<b>Surviving</b>	509 (80%)	2077 (72%)	2586 (74%)

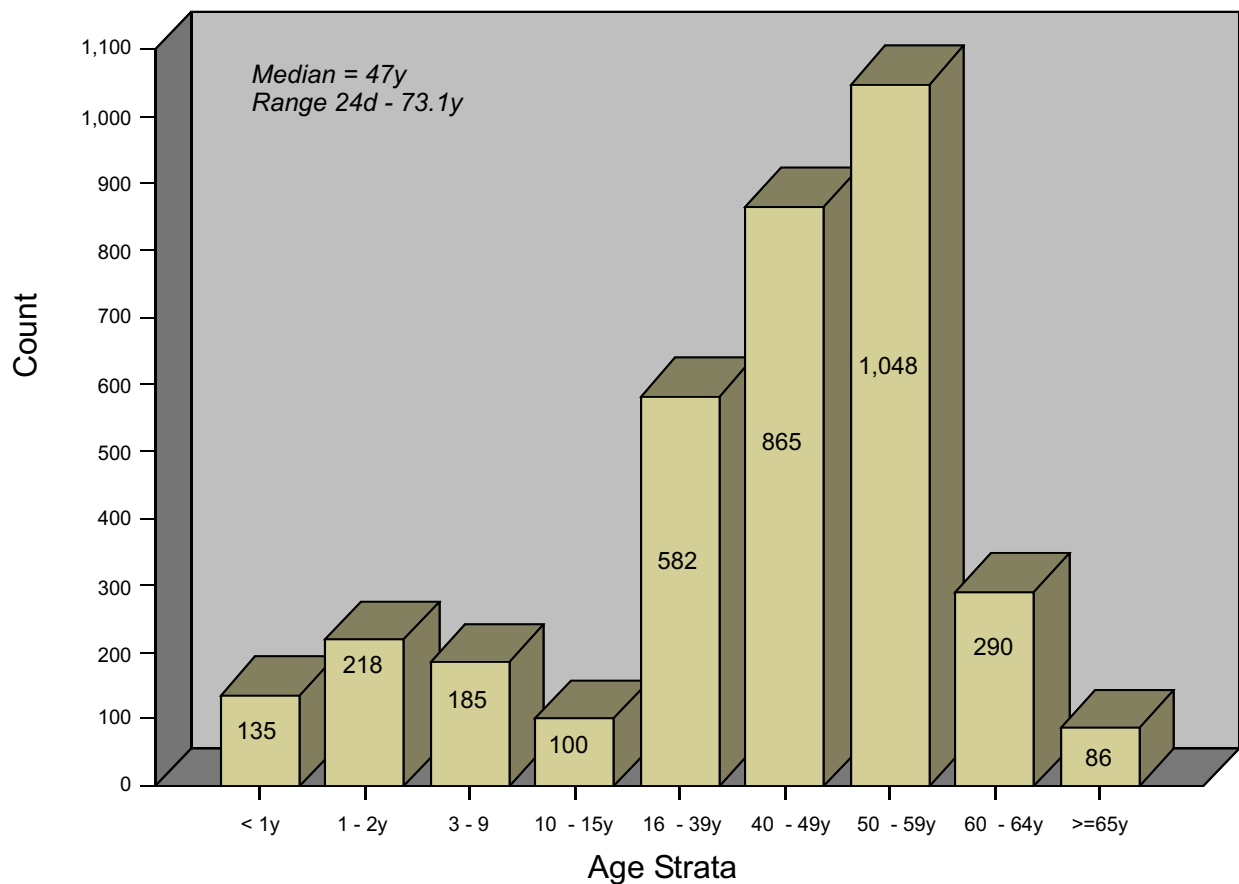


## Cumulative Number of New Patients Transplanted

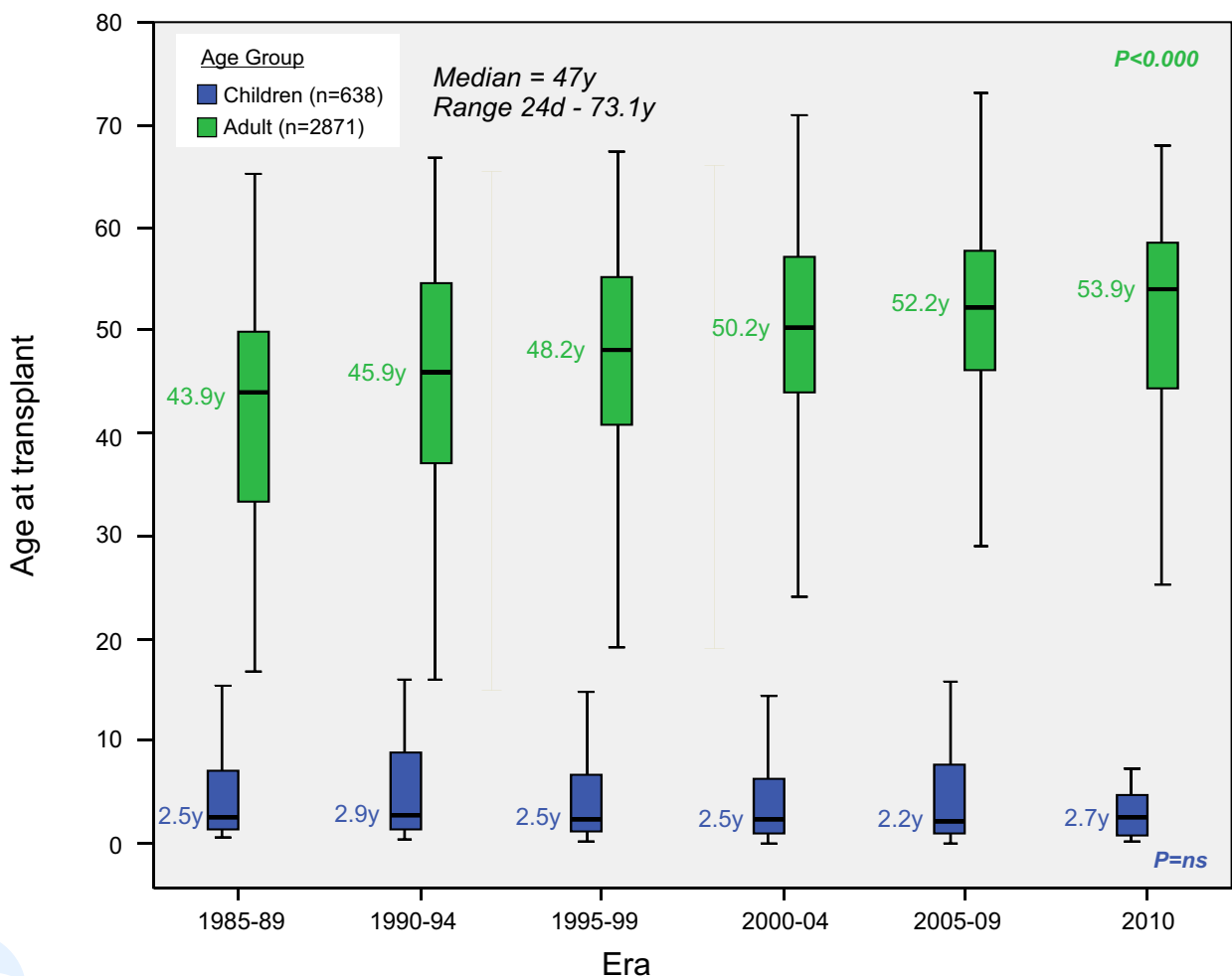


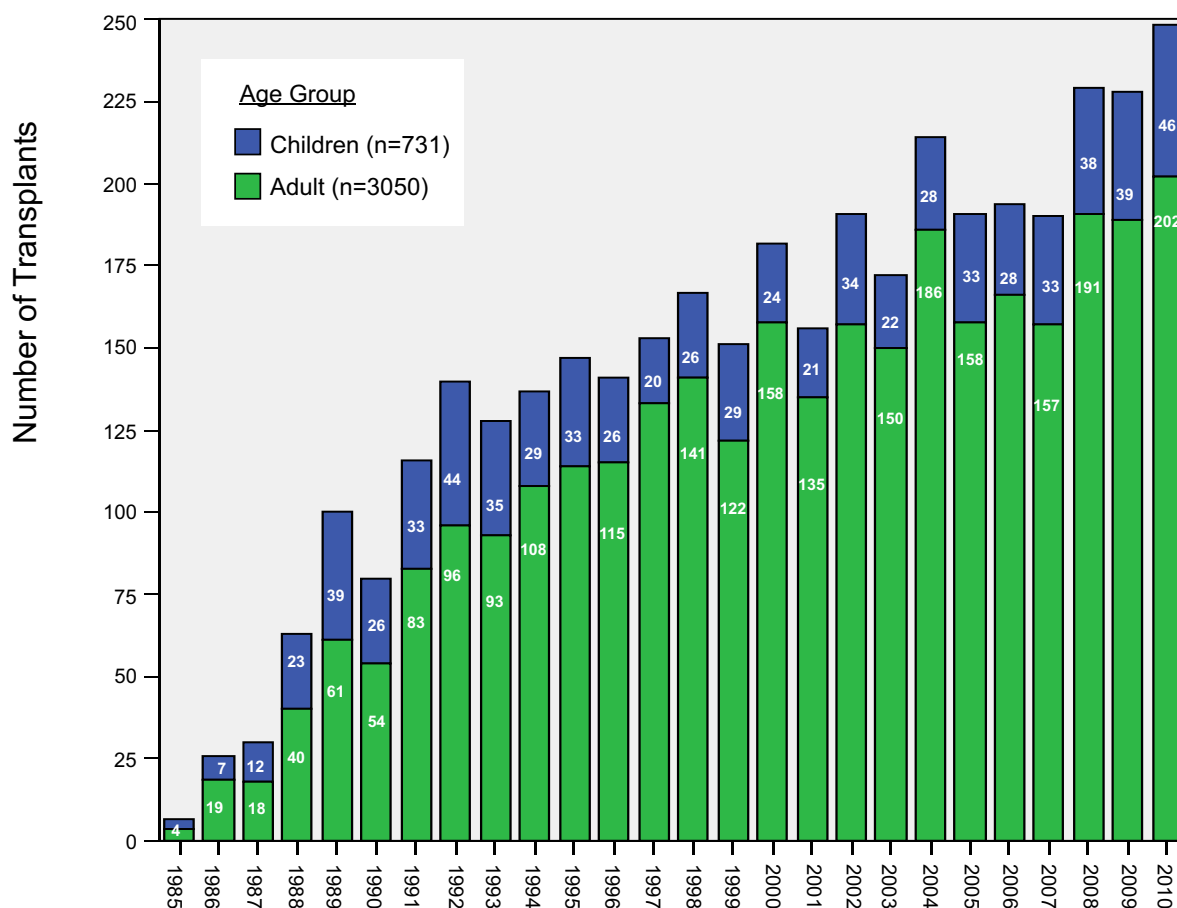
# Number of Recipients By Age at Primary Transplant

N=3509

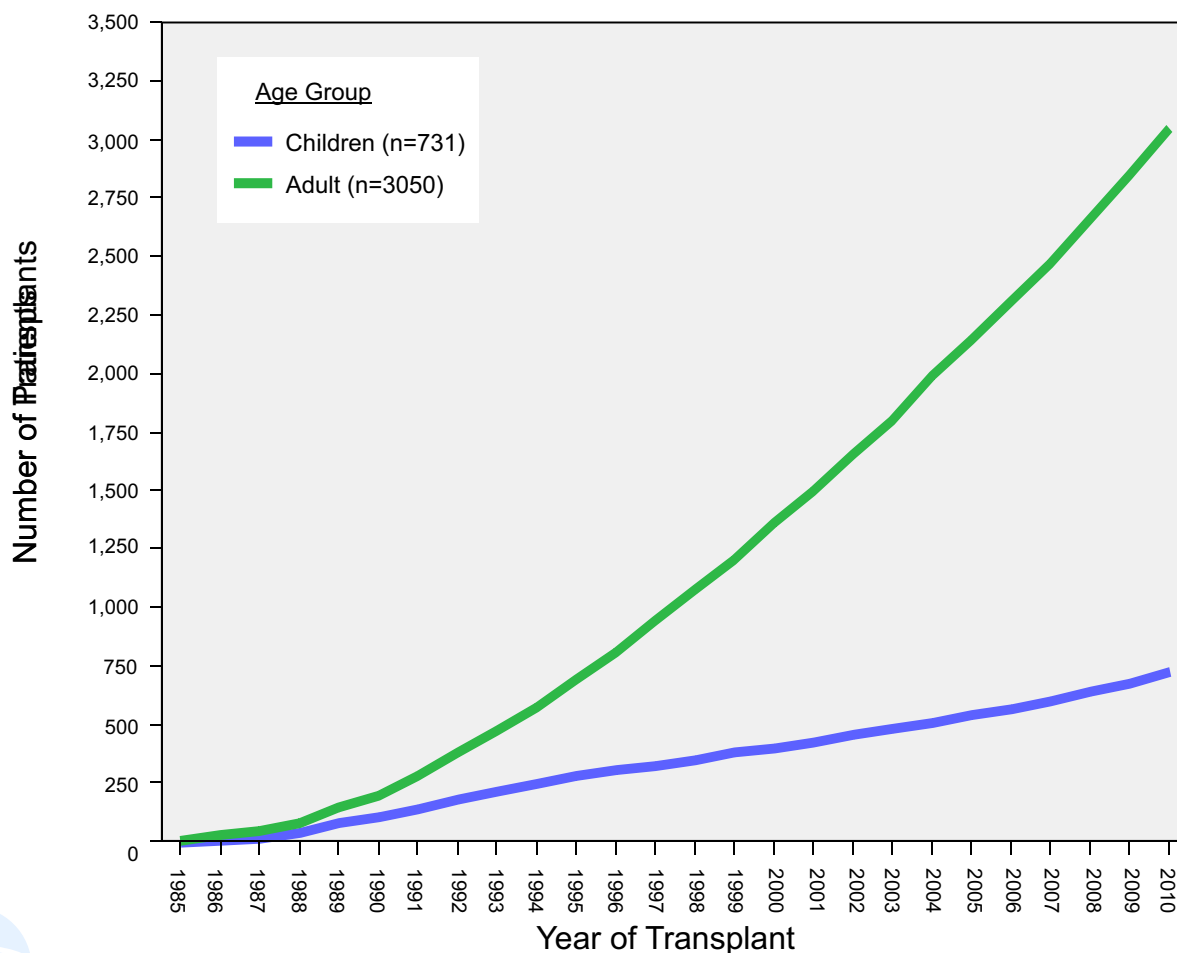


## Age at Primary Transplant by Era





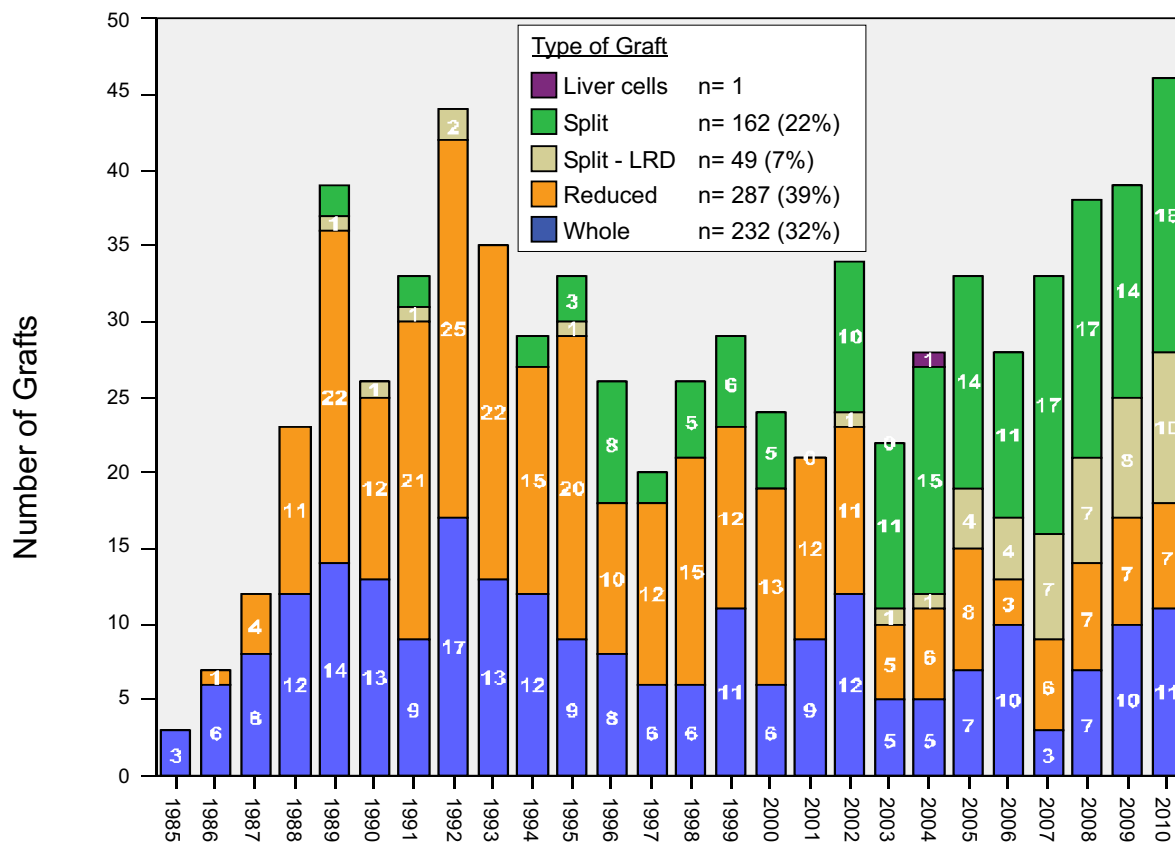
## Cumulative Number of Transplants



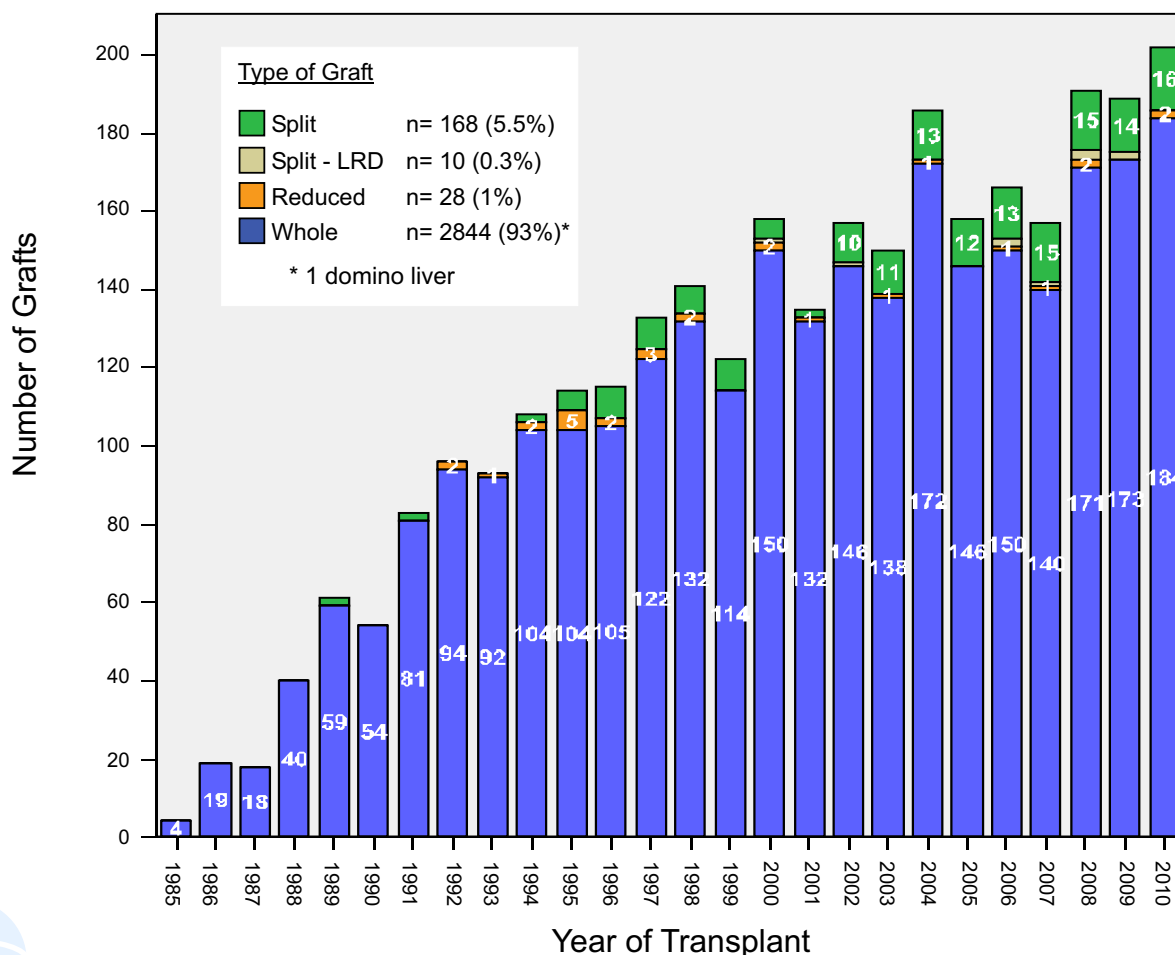
# Type of Graft by Year Split vs Reduced vs Whole



Children (n = 731)



Adults (n = 3050)

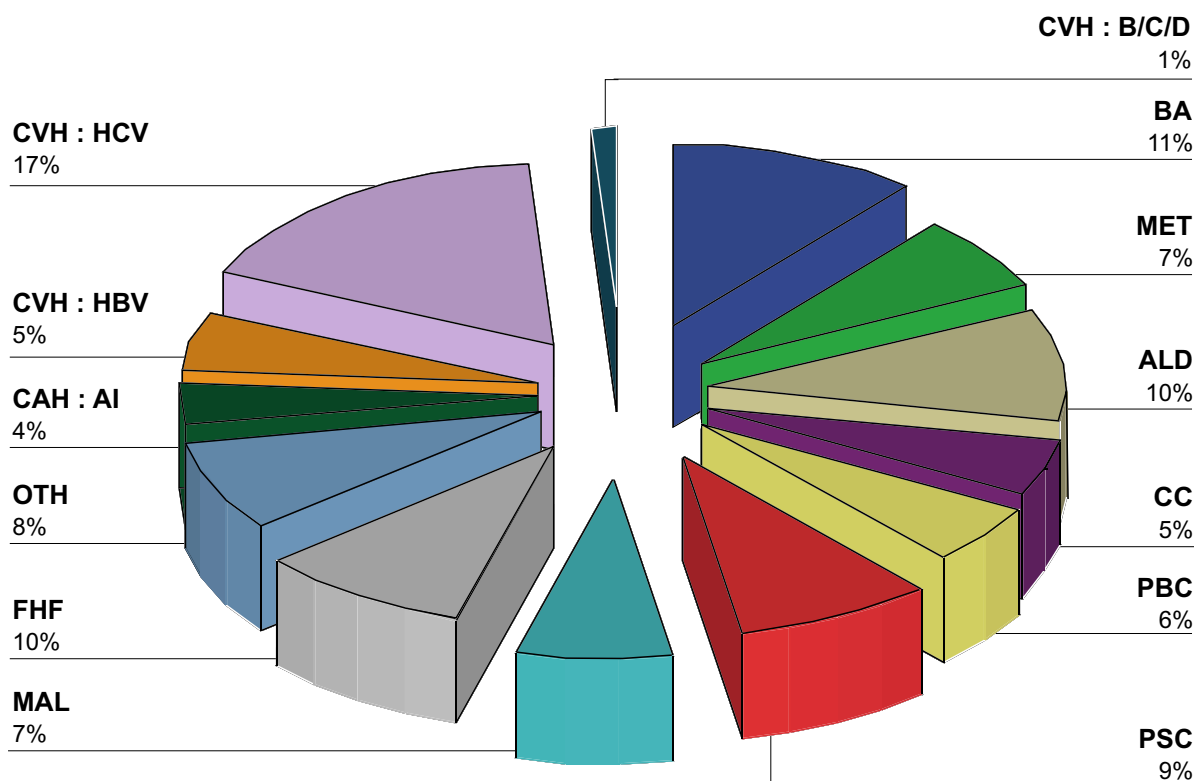




# Section 2

## Primary Diagnosis





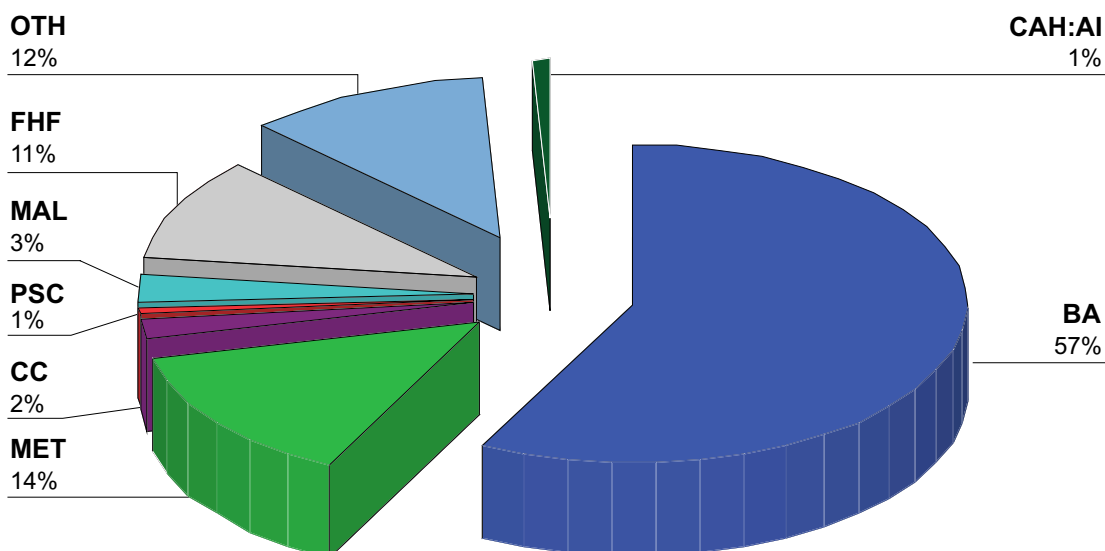
## Diagnosis Group

BA	- Biliary atresia
MET	- Metabolic diseases*
ALD	- Alcoholic cirrhosis
CC	- Cryptogenic cirrhosis
PBC	- Primary biliary cirrhosis
PSC	- Primary sclerosing cholangitis
MAL	- Malignancy
FHF	- Fulminant hepatic failure*
OTH	- Other diseases*
CAH : AI	- Chronic active hepatitis [autoimmune]
CVH : HBV	- Chronic viral hepatitis B
CVH : HCV	- Chronic viral hepatitis C
CVH : B/C/D	- Chronic viral hepatitis B / C / D

\* See Appendices for details

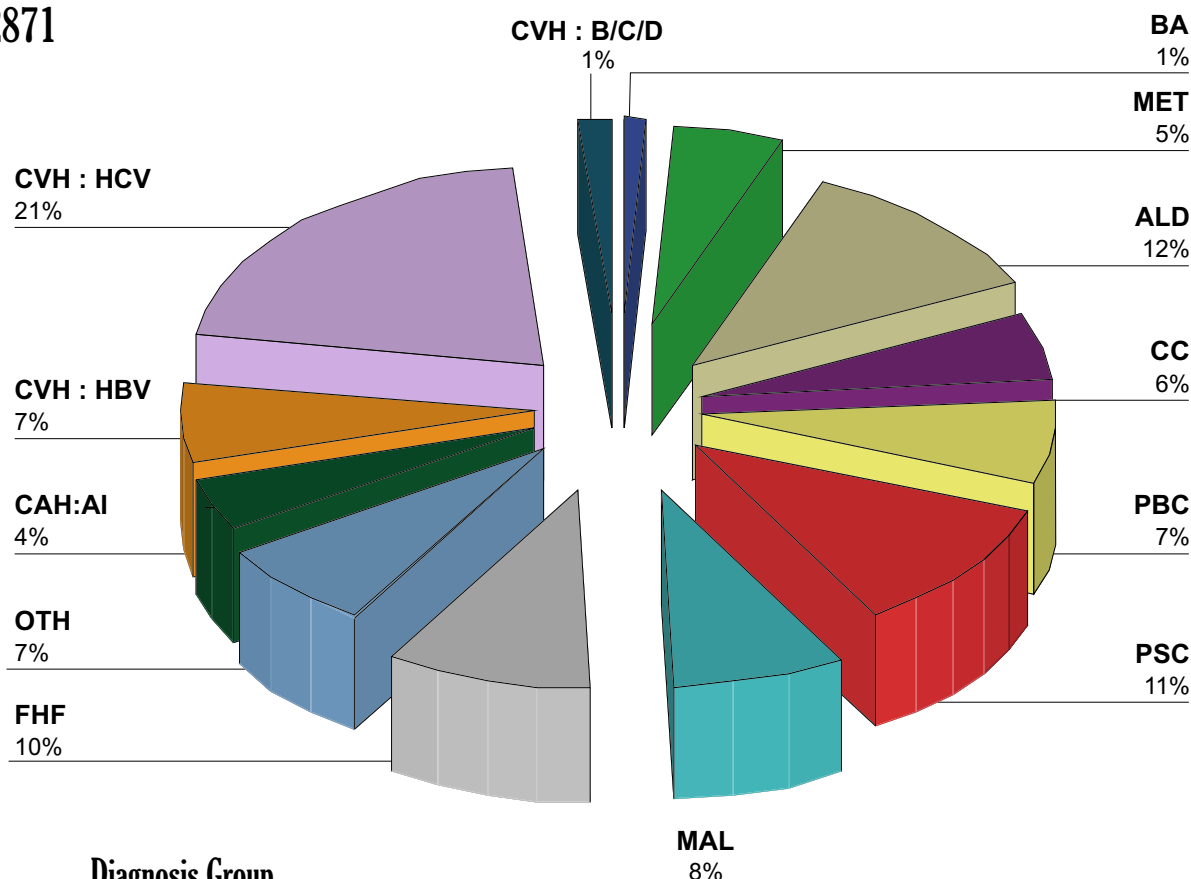
## Primary Diseases of Children

n = 638



## Primary Diseases of Adult Recipients

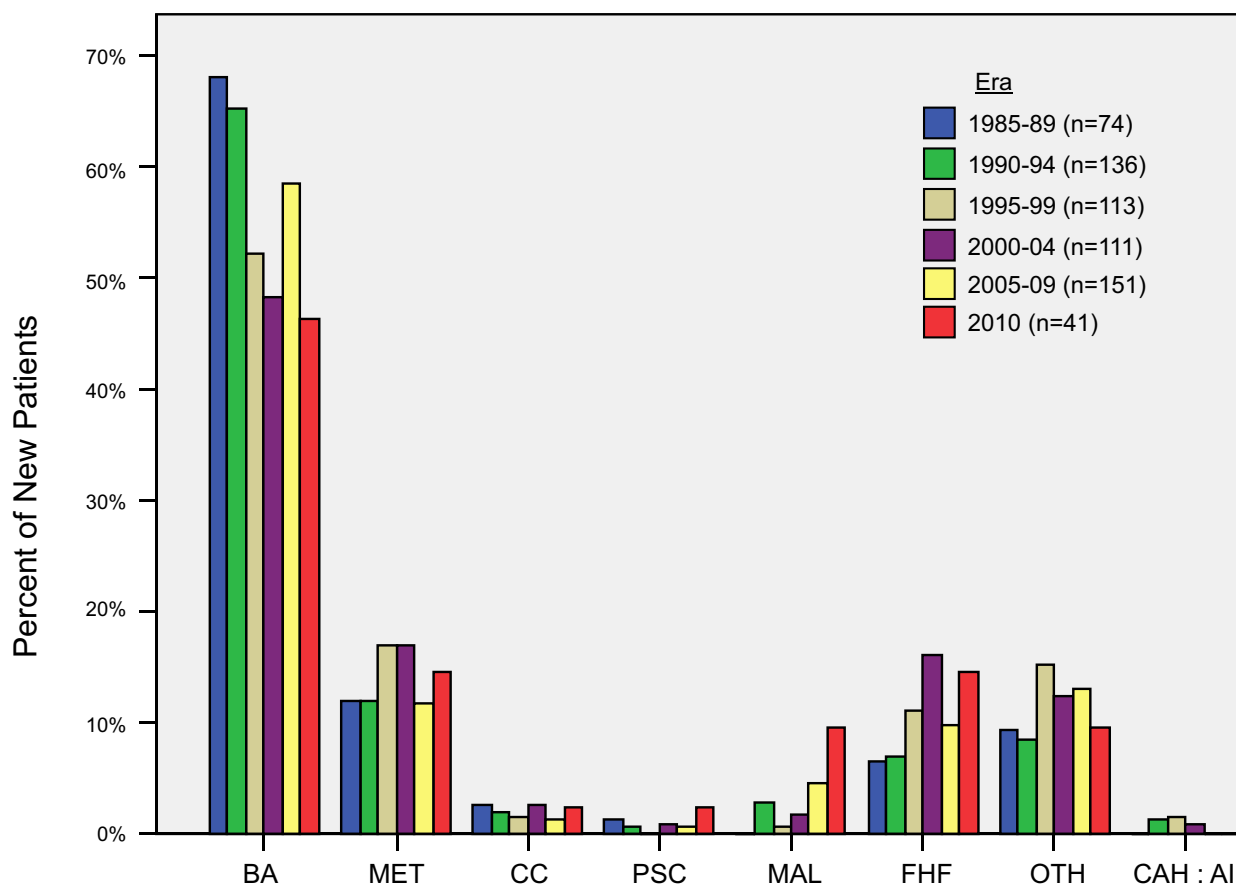
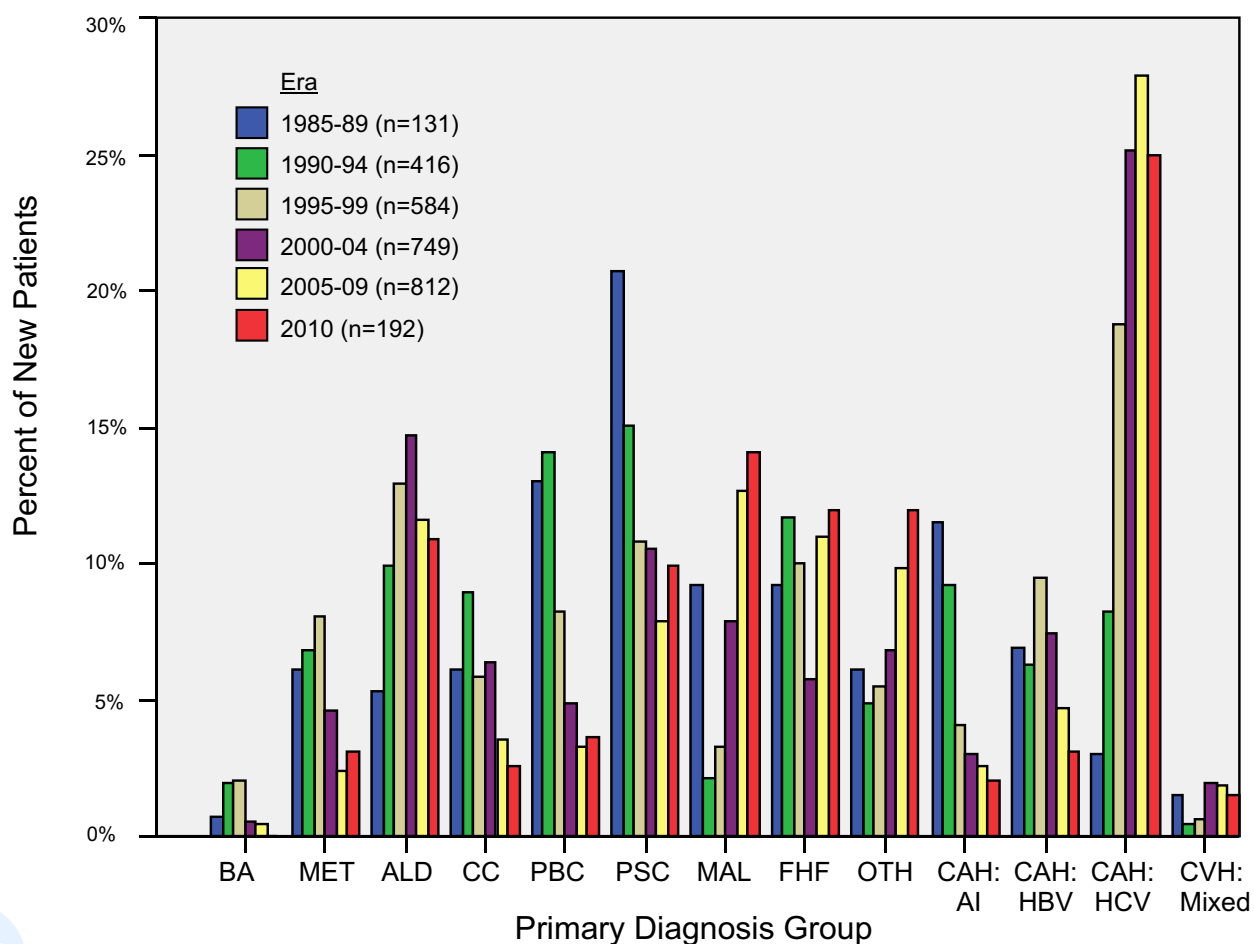
n = 2871

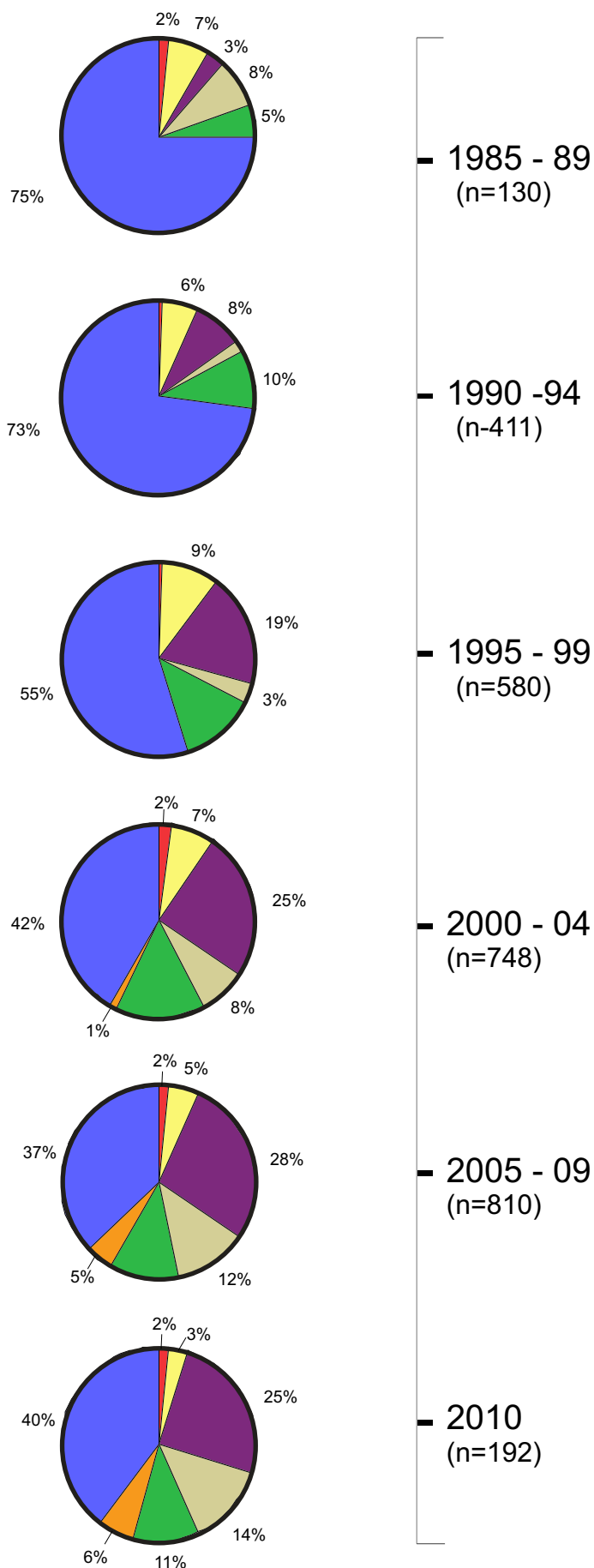


### Diagnosis Group

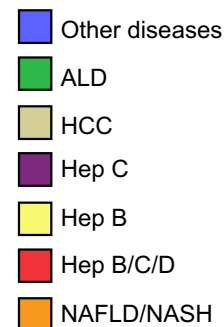
BA	- Biliary atresia	MAL	- Malignancy
MET	- Metabolic diseases	FHF	- Fulminant hepatic failure
ALD	- Alcoholic cirrhosis	OTH	- Other diseases
CC	- Cryptogenic cirrhosis	CAH : AI	- Chronic active hepatitis [autoimmune]
PBC	- Primary biliary cirrhosis	CVH : HBV	- Chronic viral hepatitis B
PSC	- Primary sclerosing cholangitis	CVH : HCV	- Chronic viral hepatitis C
		CVH : B/C/D	- Chronic viral hepatitis B / C / D



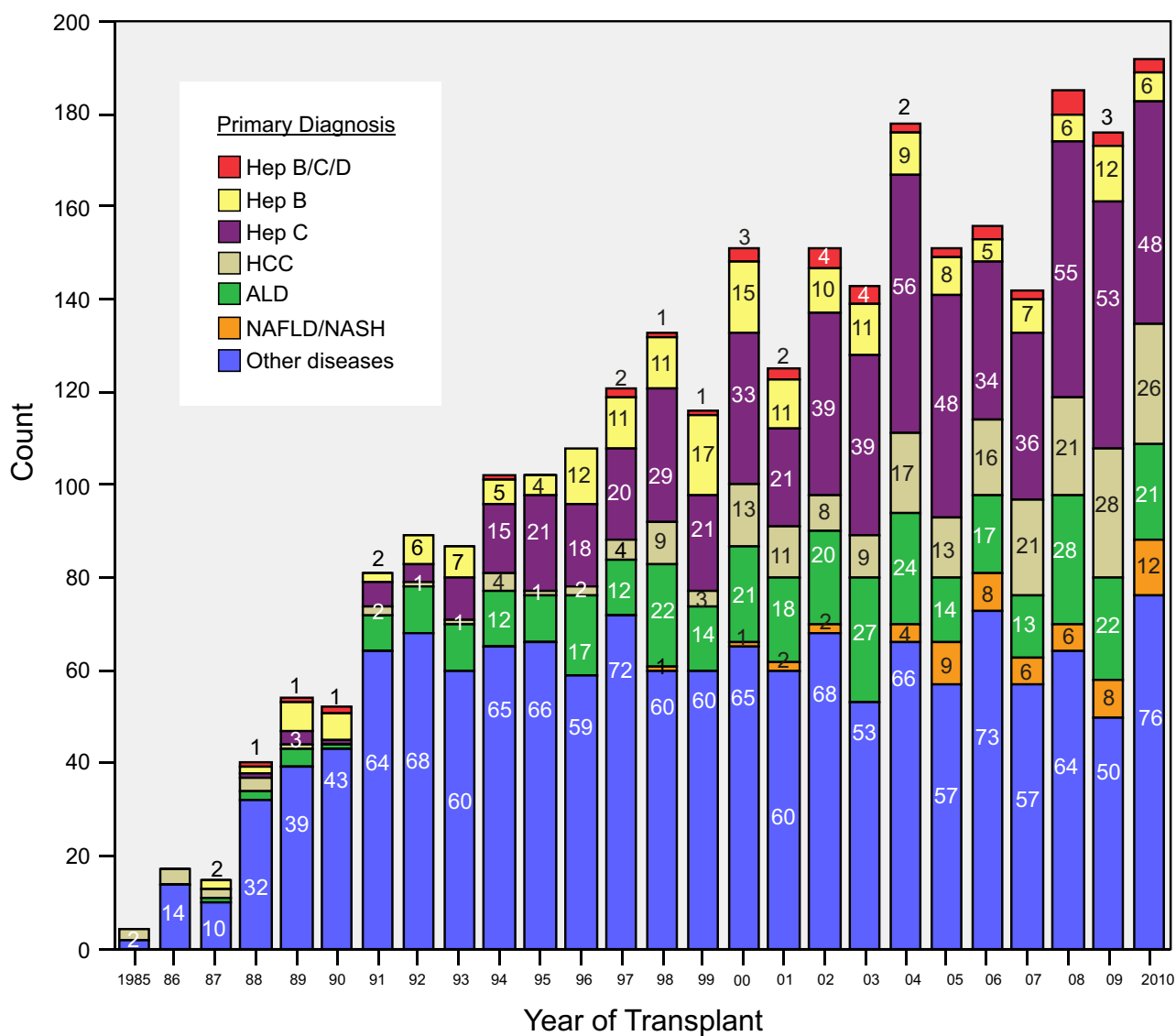
**Children (n=638)****Adults (n = 2871)**



## Adult Diagnosis



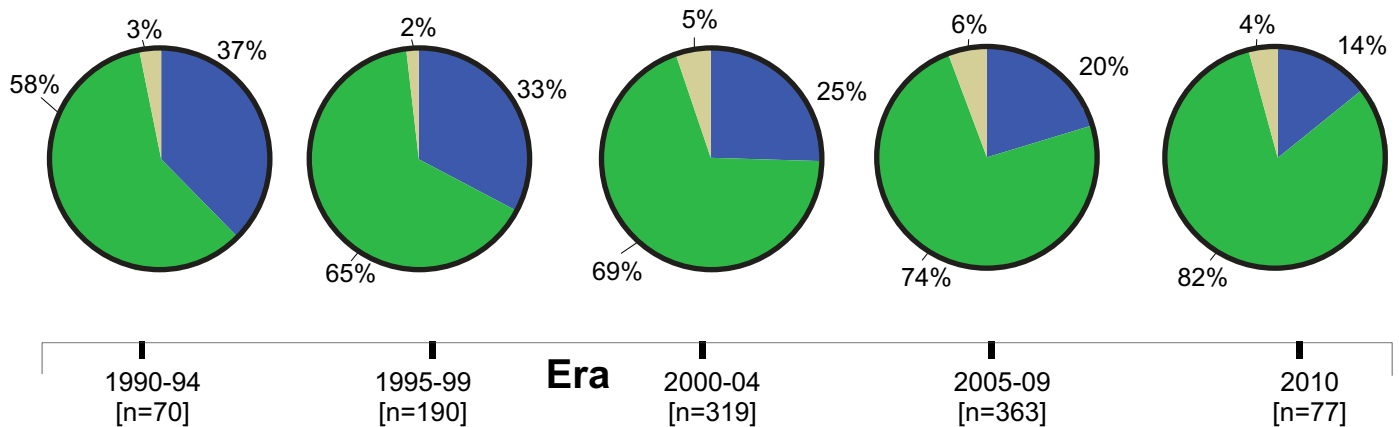
## Era



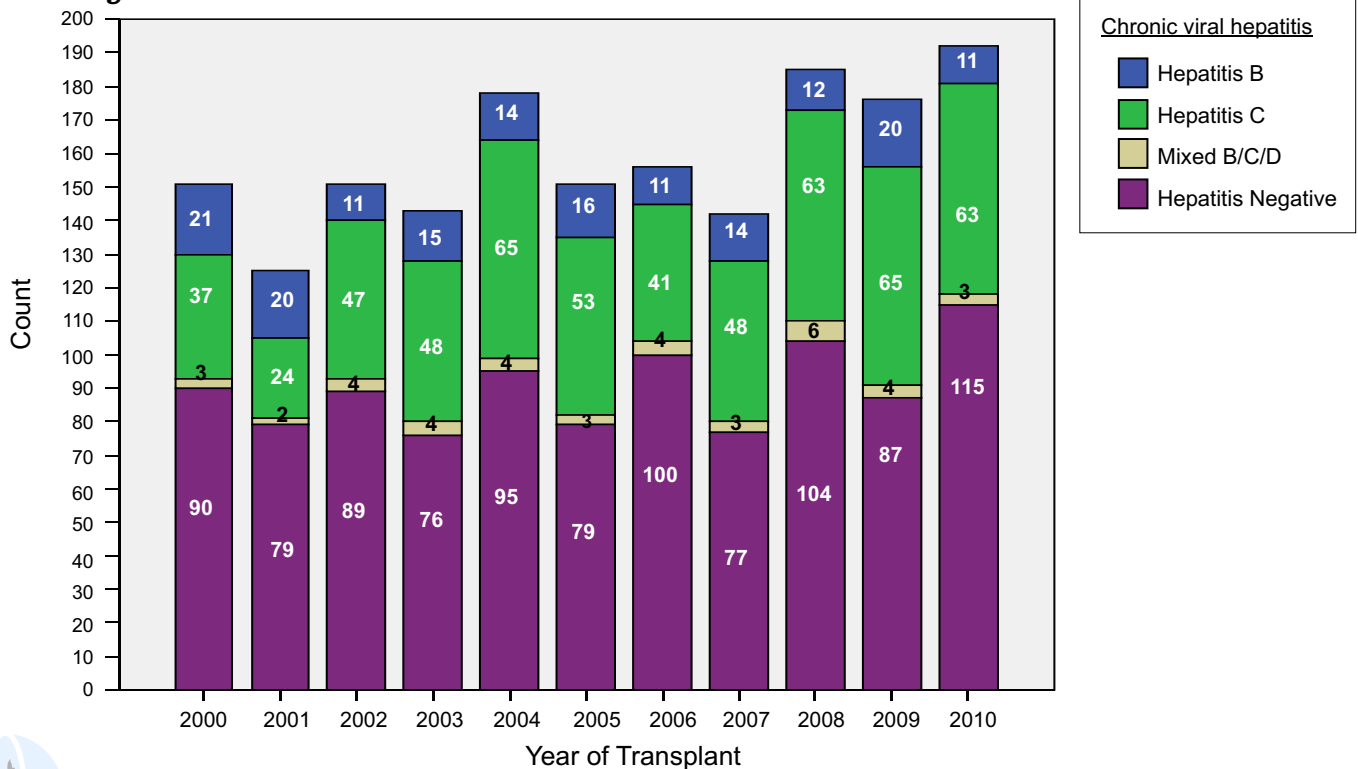


			Secondary / Tertiary diagnosis					
Primary Diagnosis		n =	Hepatitis C	Hepatitis B	Hepatitis B,C	HCC	NAFLD	ALD
	Hepatitis C	609		8		141	1	147
	Hepatitis B	190	2			65		4
	Hepatitis BD/BC/BCD	41				4		7
	HCC + cirrhosis	215	95	67	5		5	30
	ALD	349	13	3		37	3	
	NAFLD	58		2		8		1
	Other	1409	13	7		40	3	21
TOTAL		2871						

## Type of Chronic Viral Hepatitis in Adult Patients



## Hepatitis diagnosis

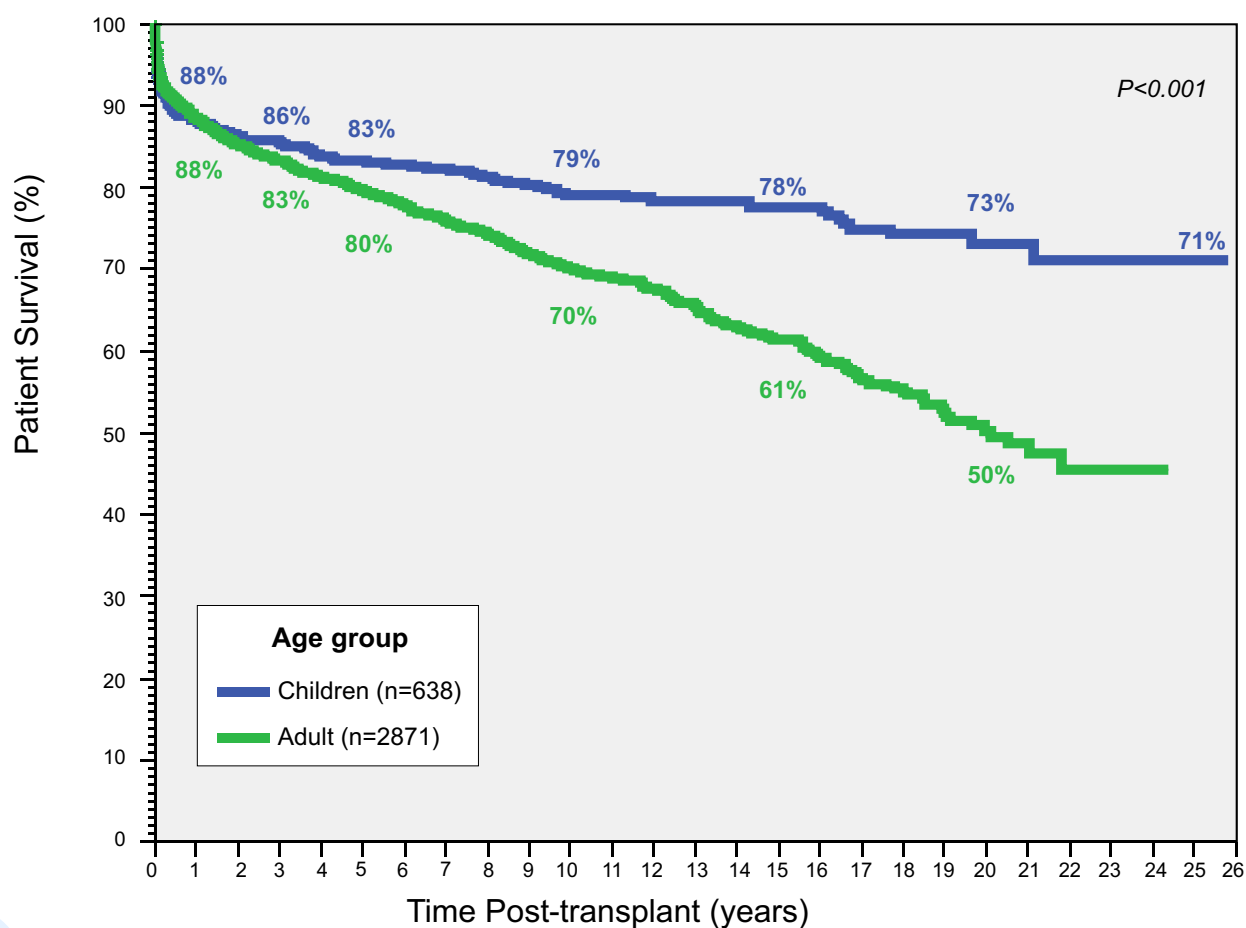
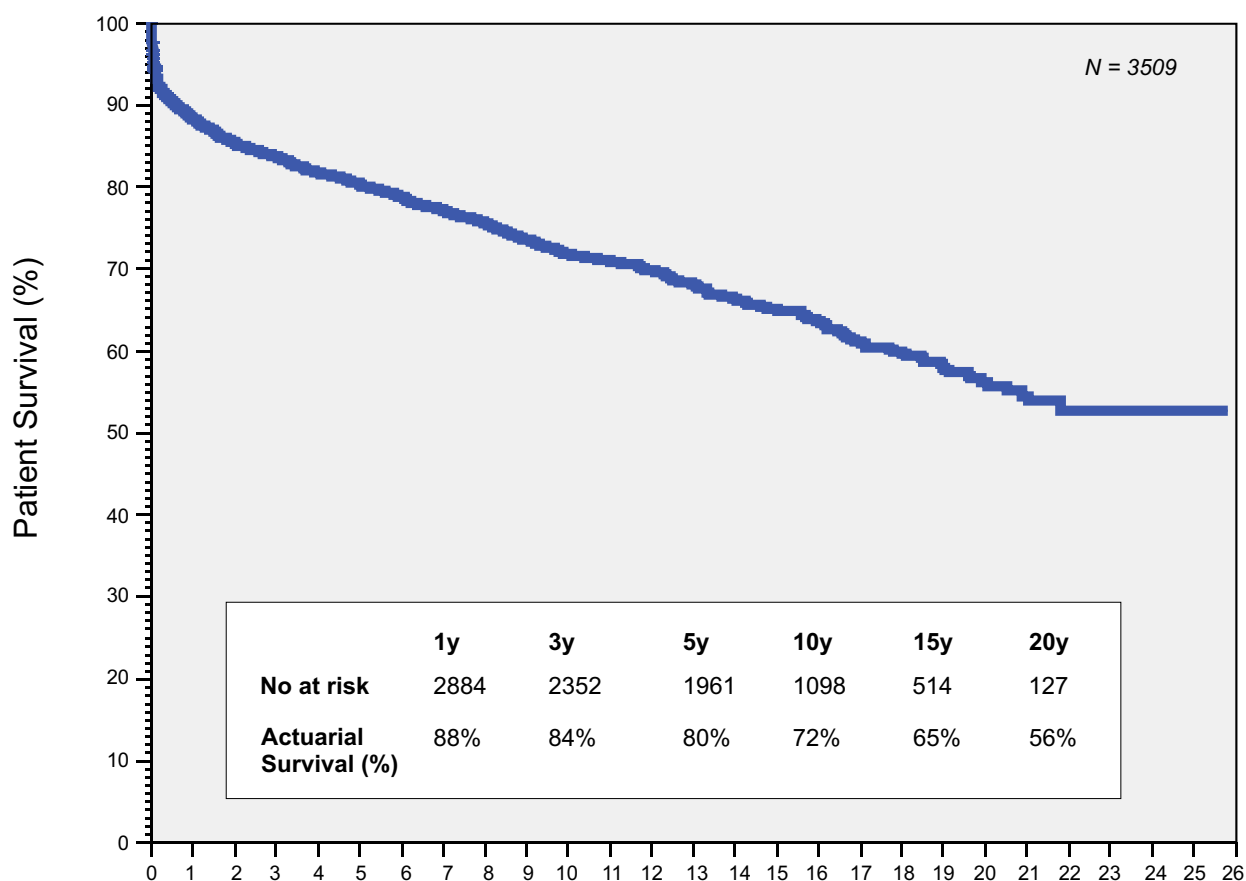




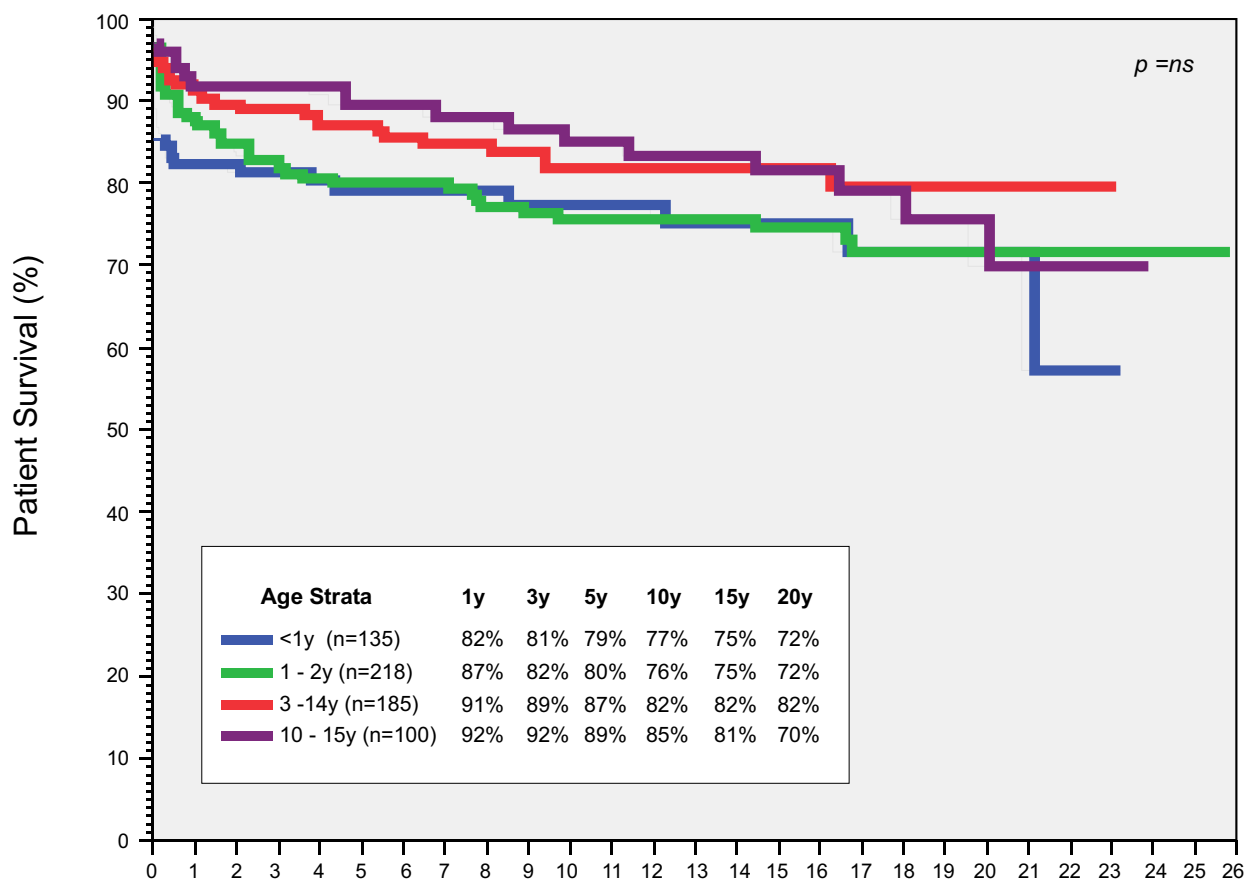
# Section 3

## Patient Survival

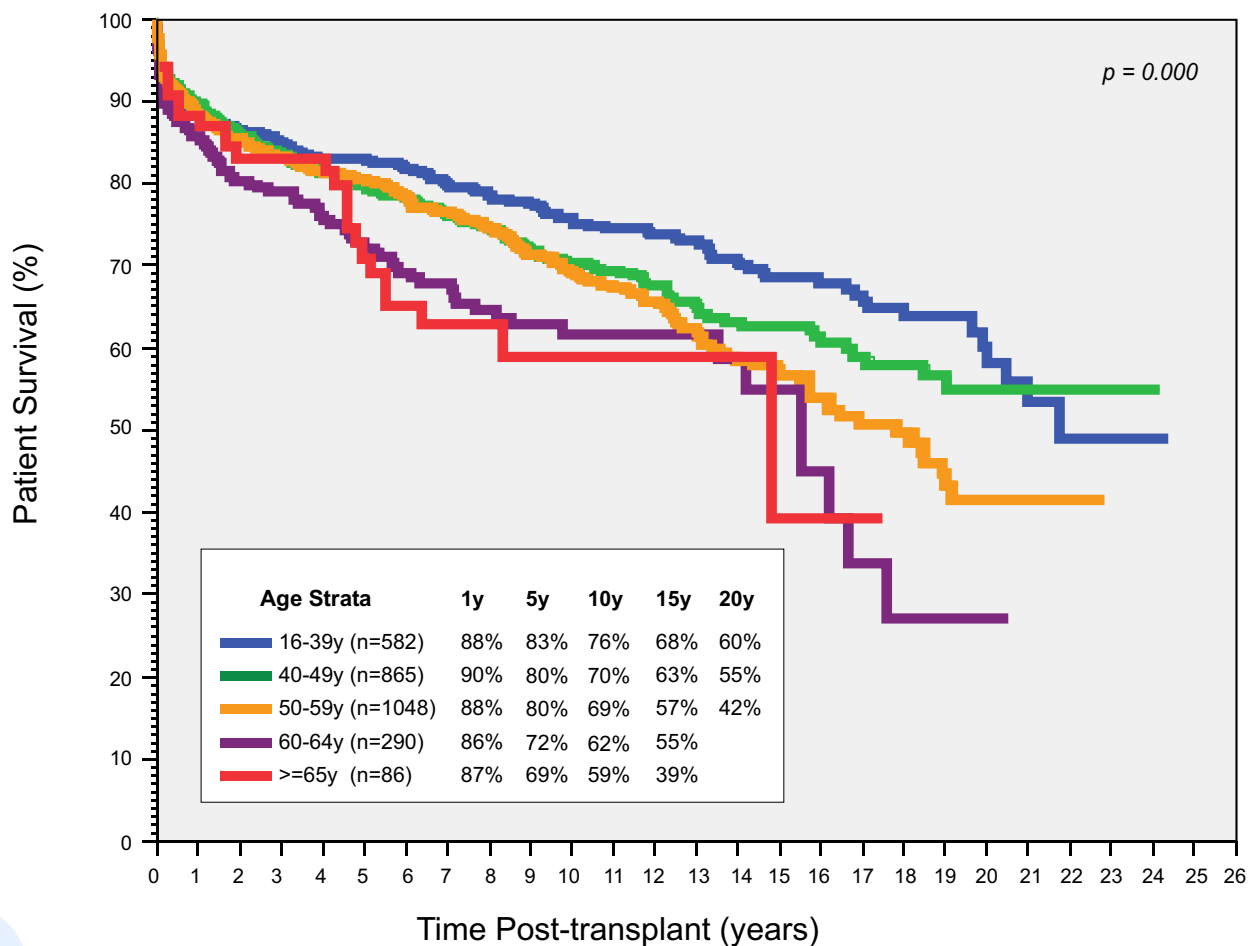


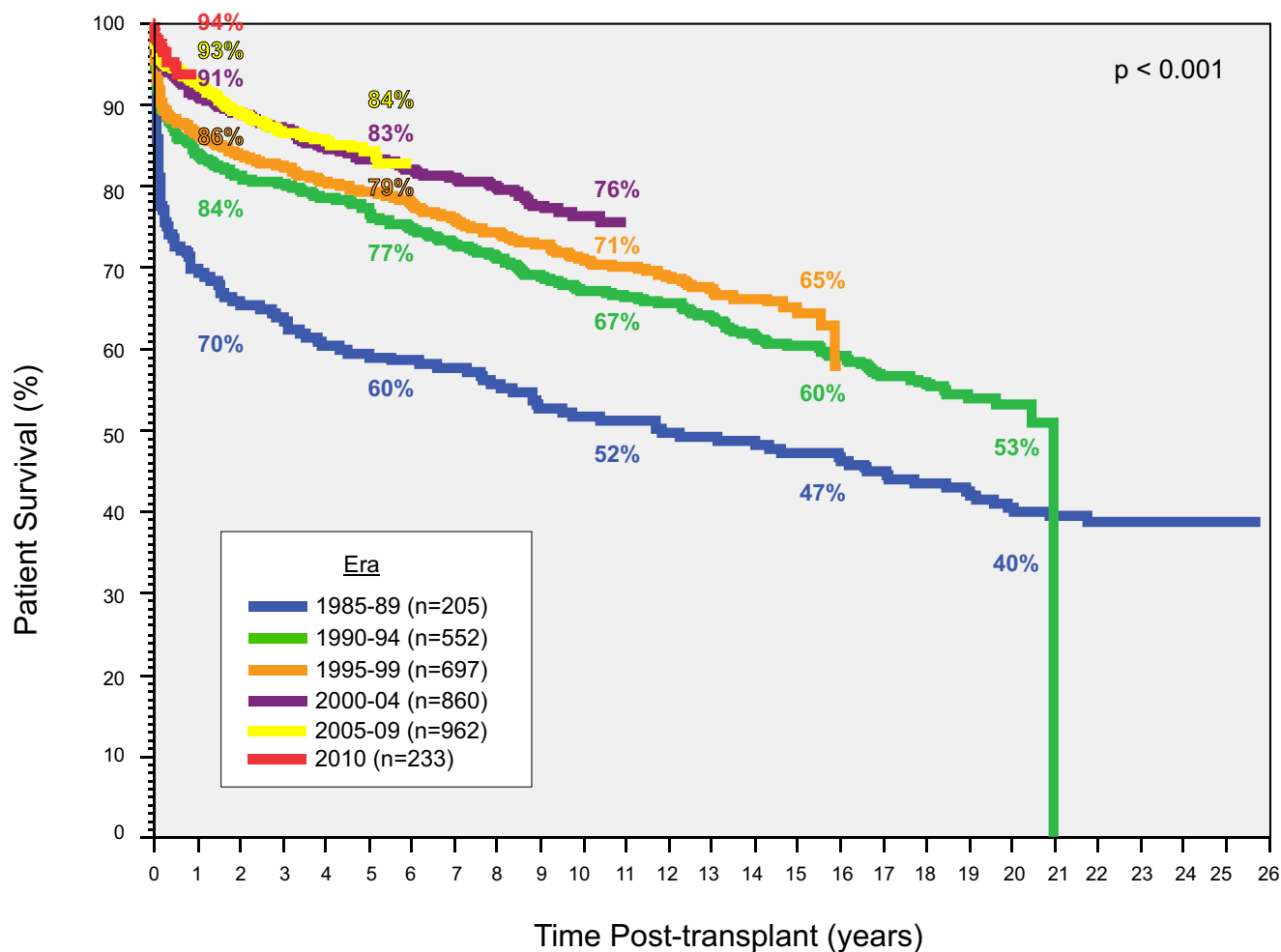


## Children n = 638

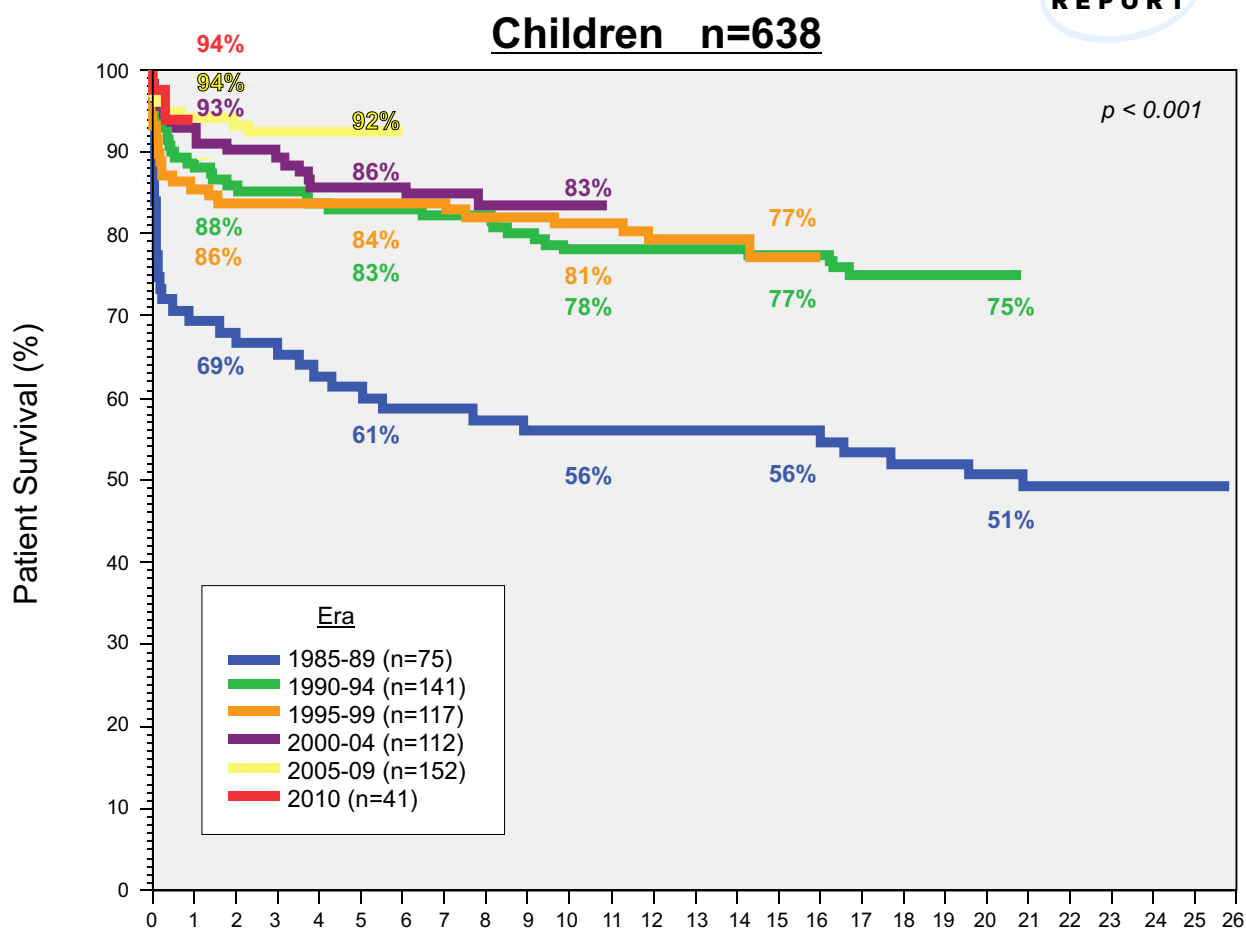


## Adults n = 2871



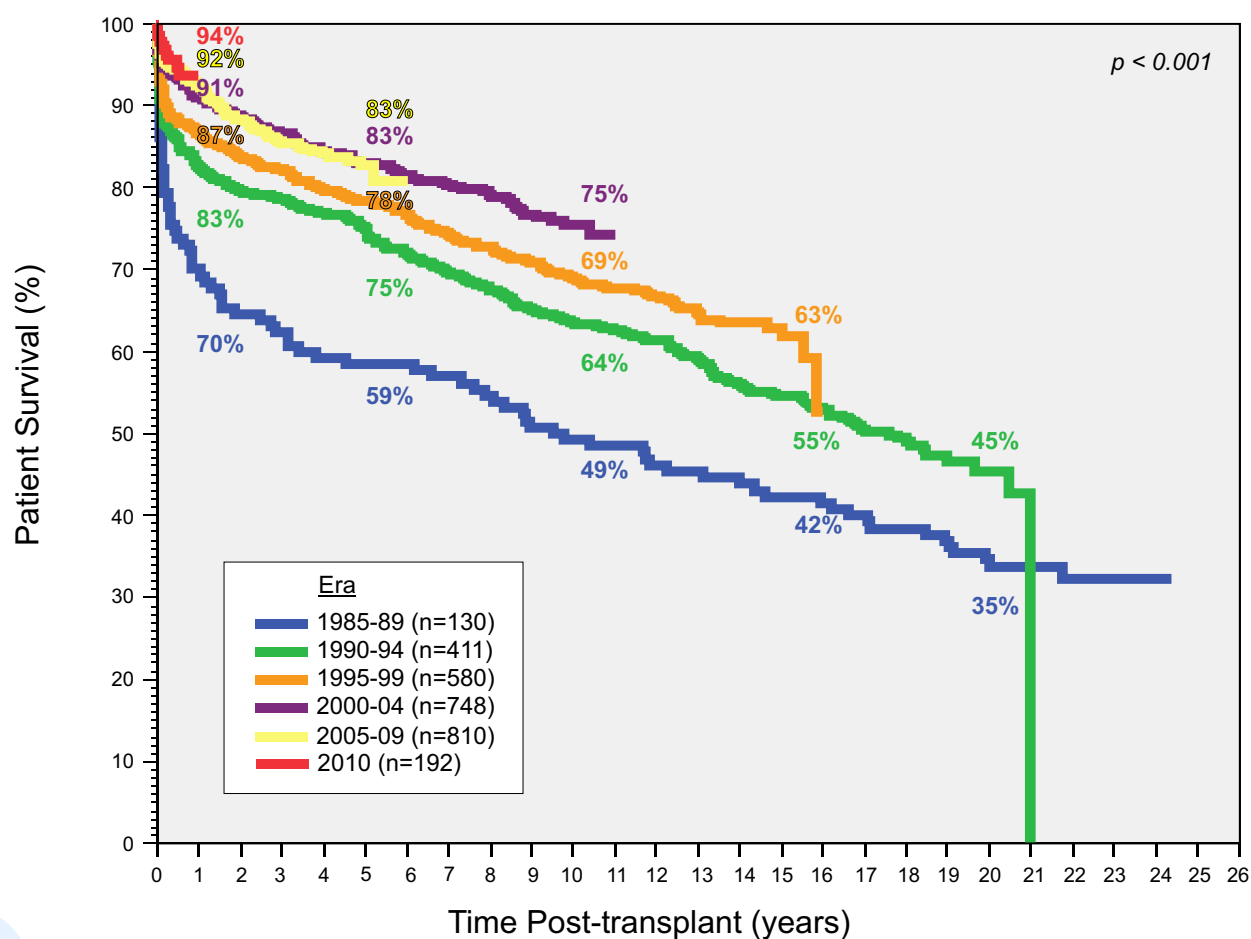






# Patient Survival - Adults

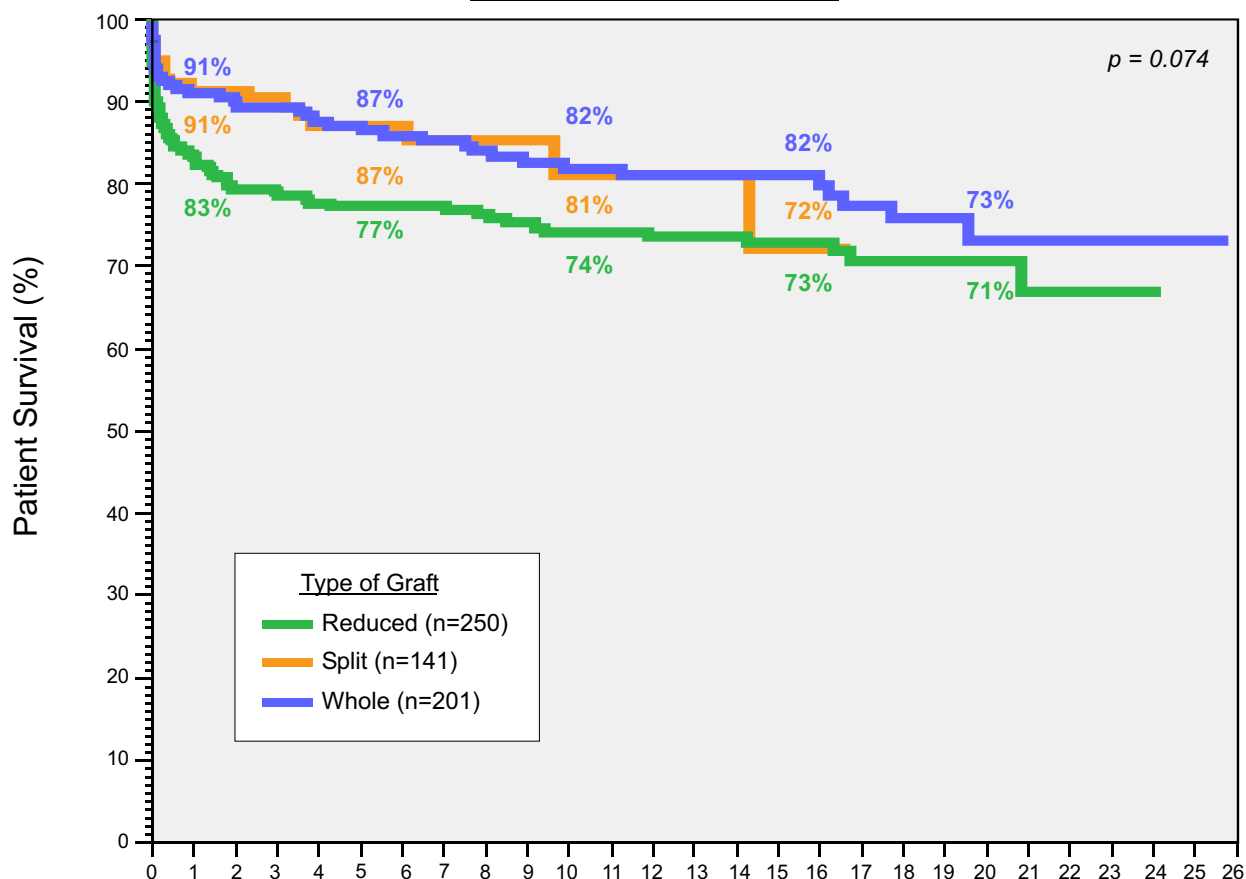
## Adults n = 2871



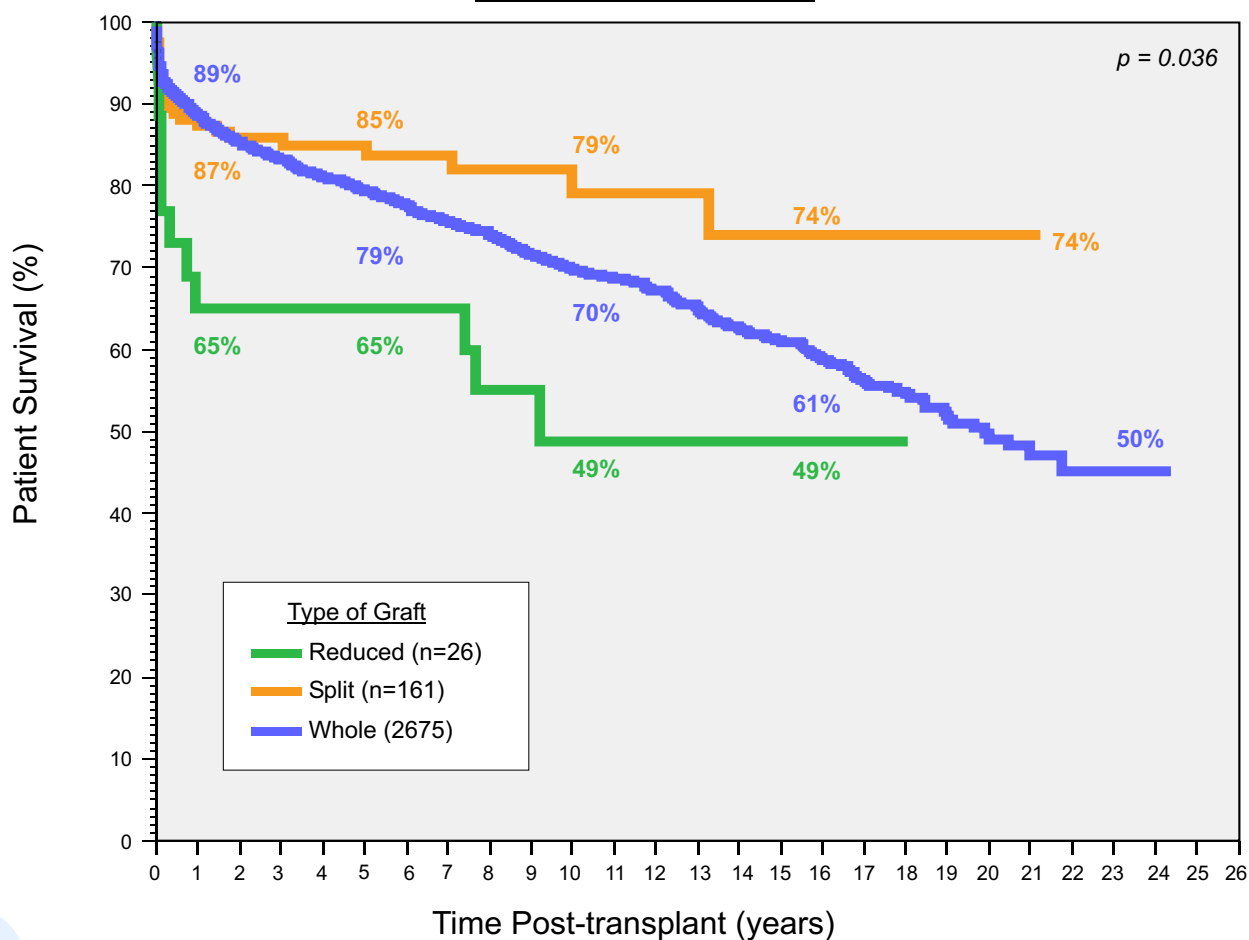
# Patient Survival by Type of Primary Graft [Deceased donors]

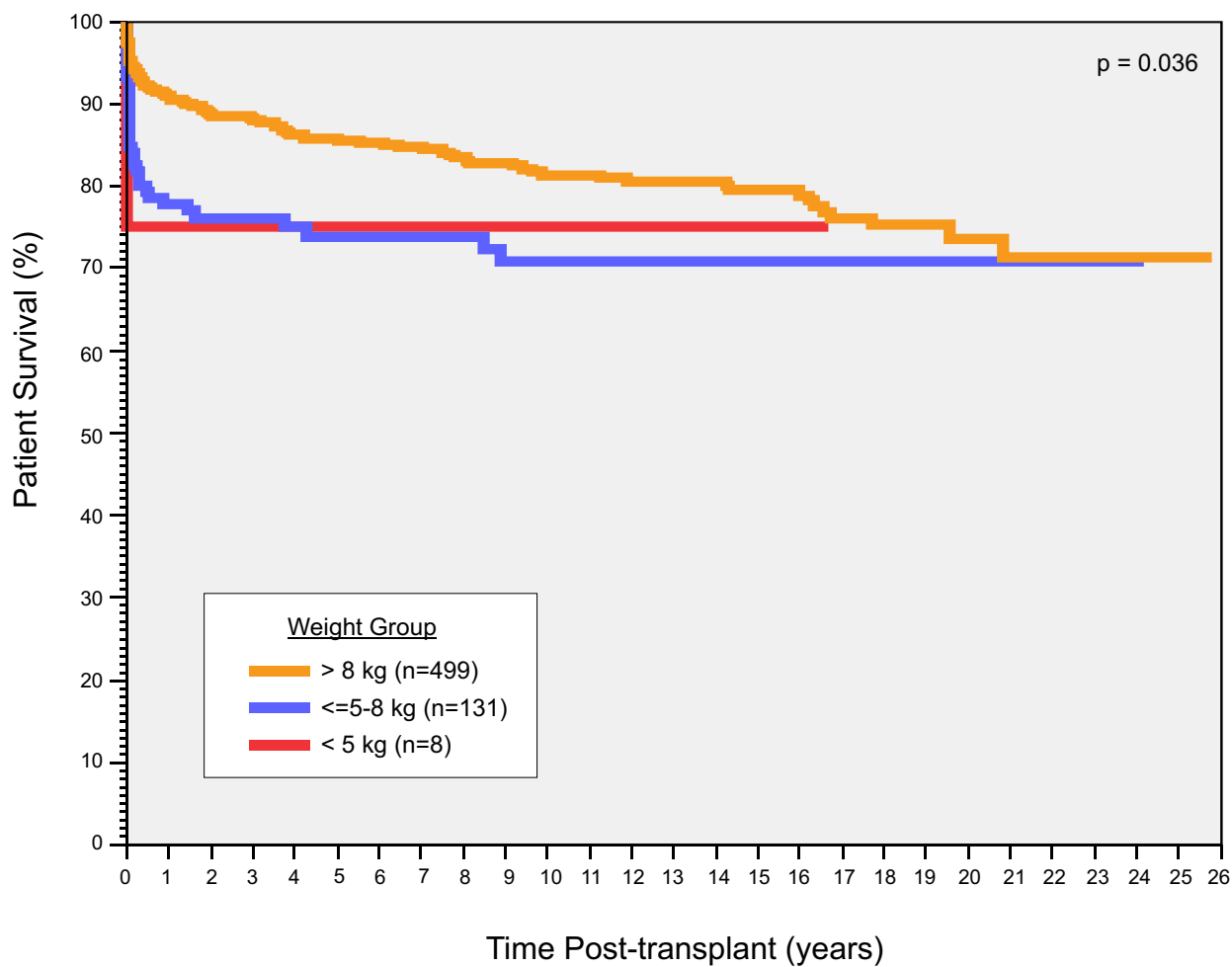


## Children - n = 592



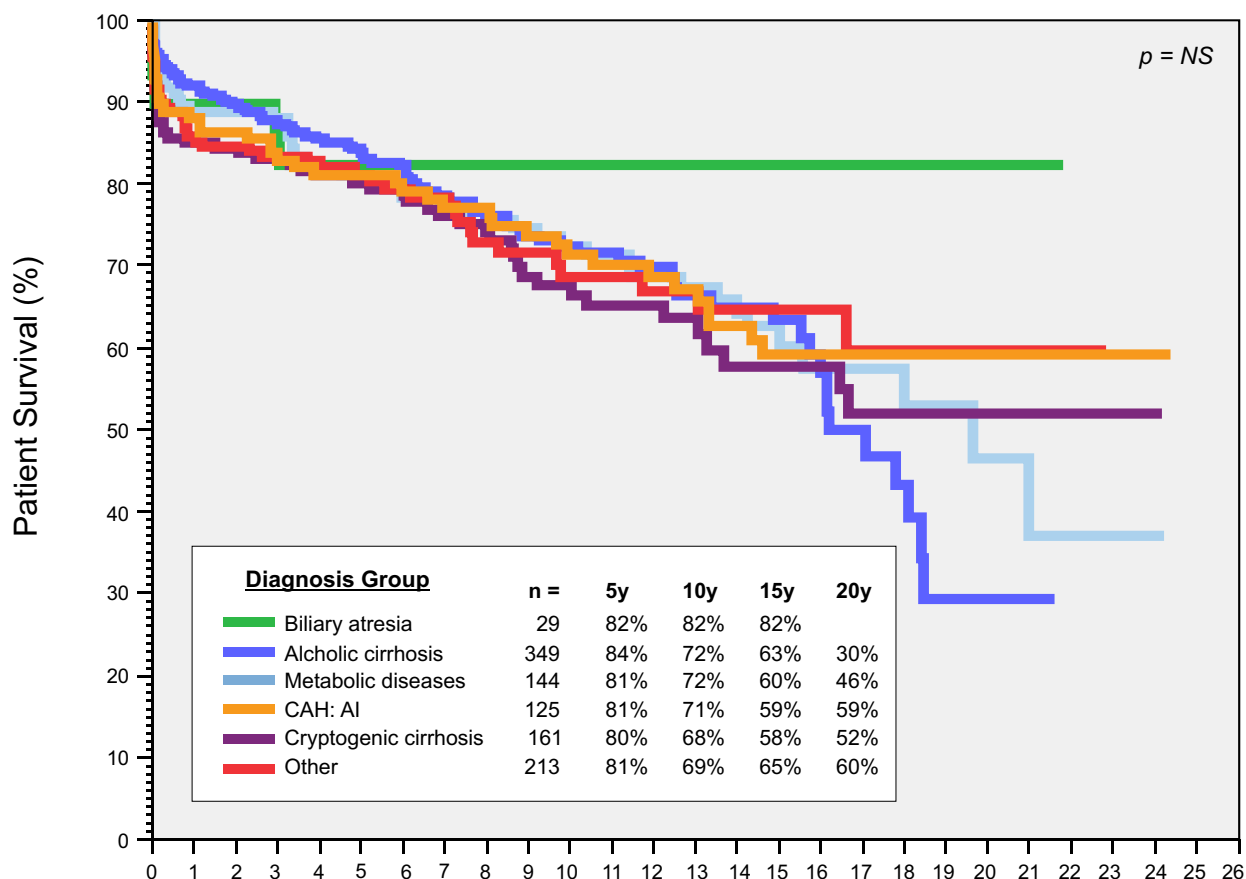
## Adults - n = 2862



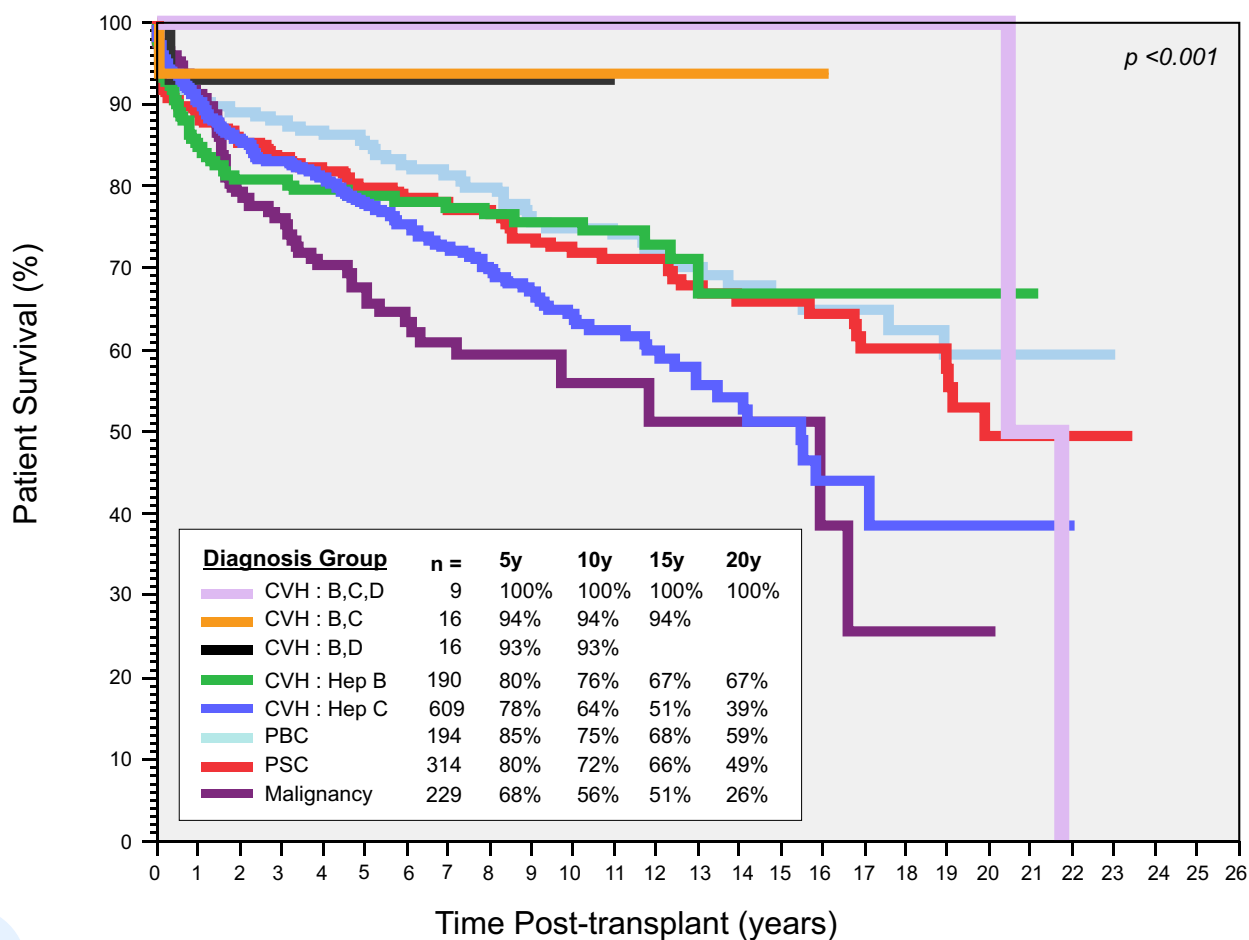




## (1) Adults [excluding FHF] - n=1021

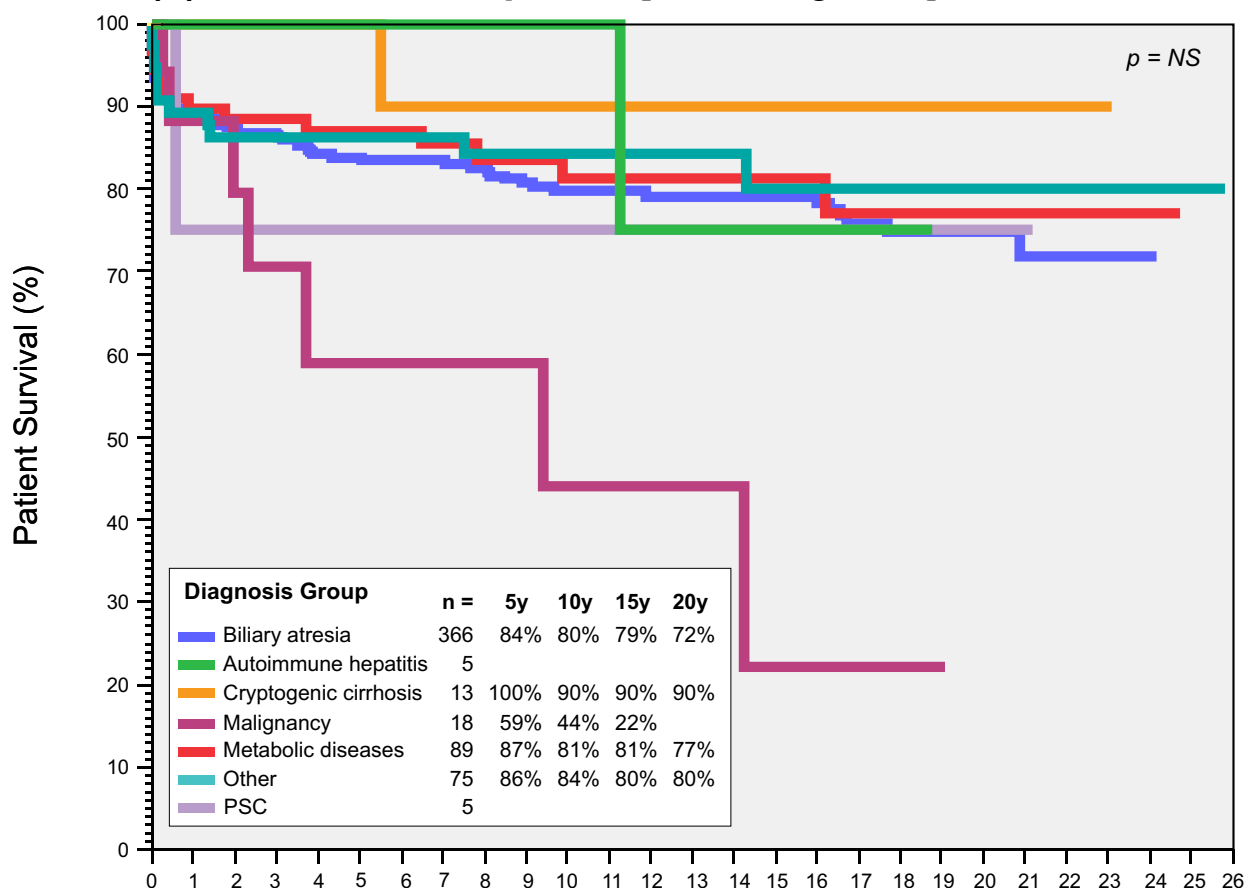


## (2) Adults [excluding FHF] - n=1577

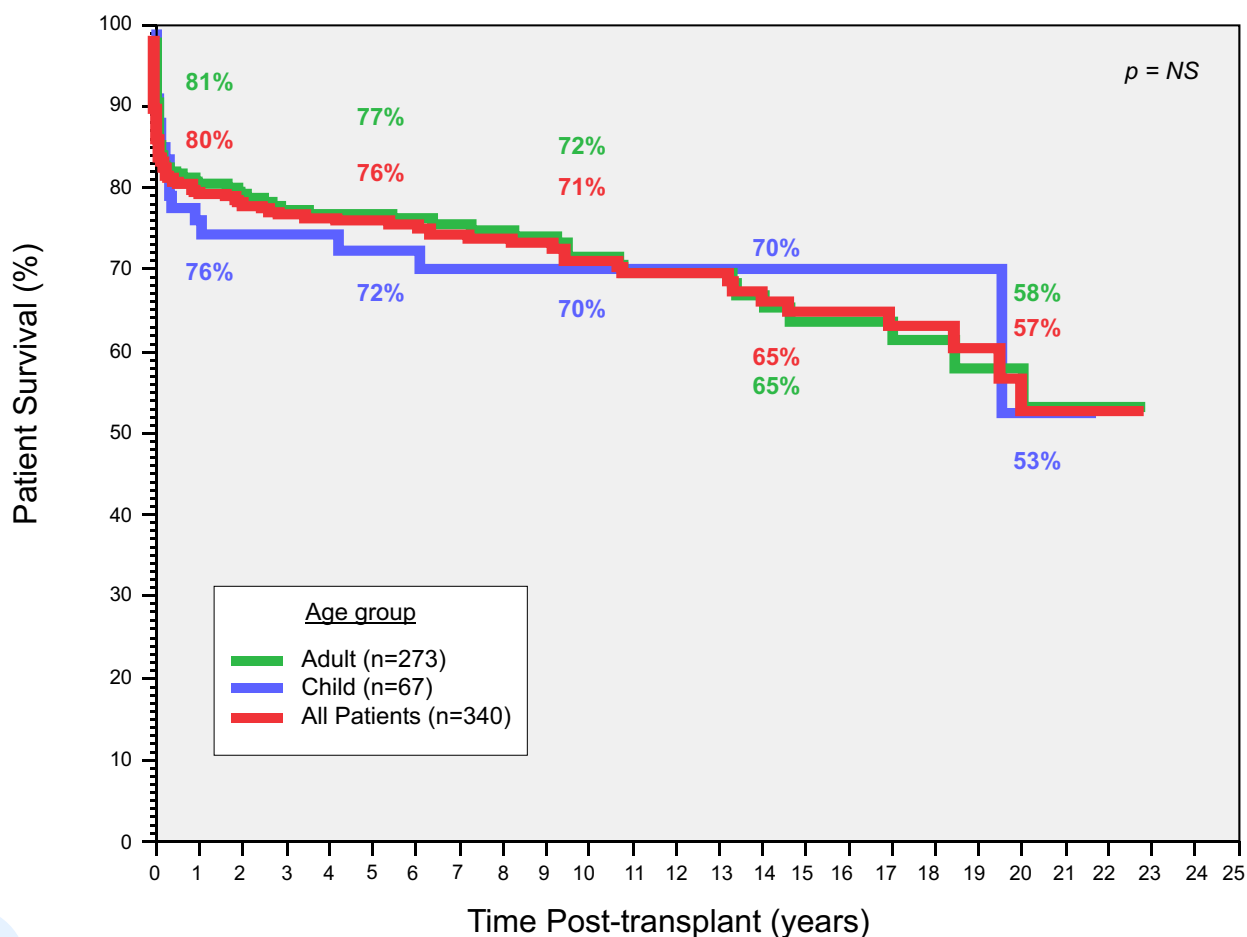


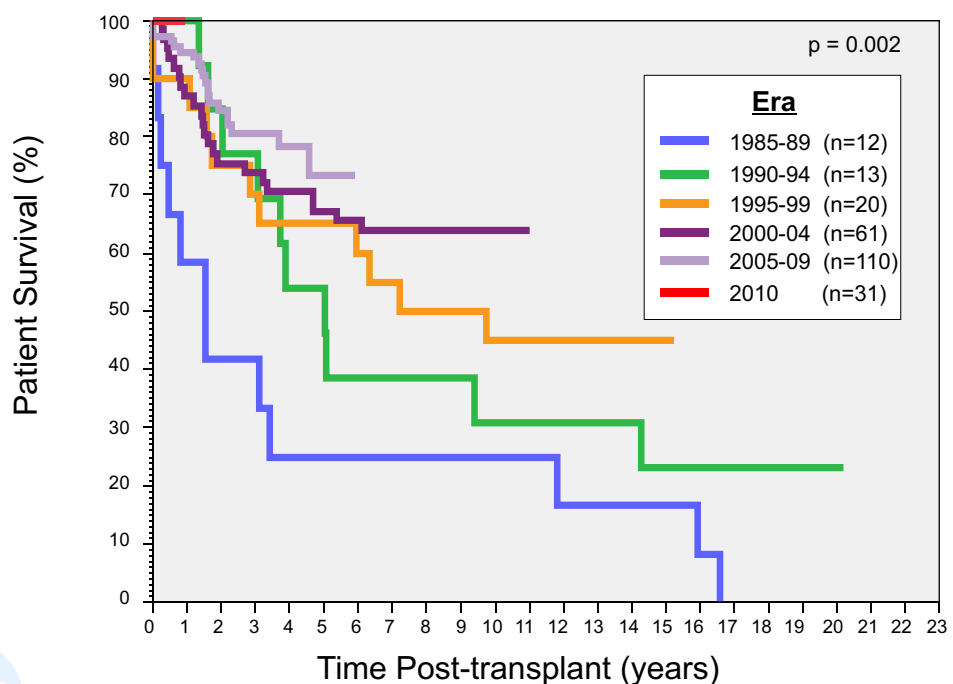
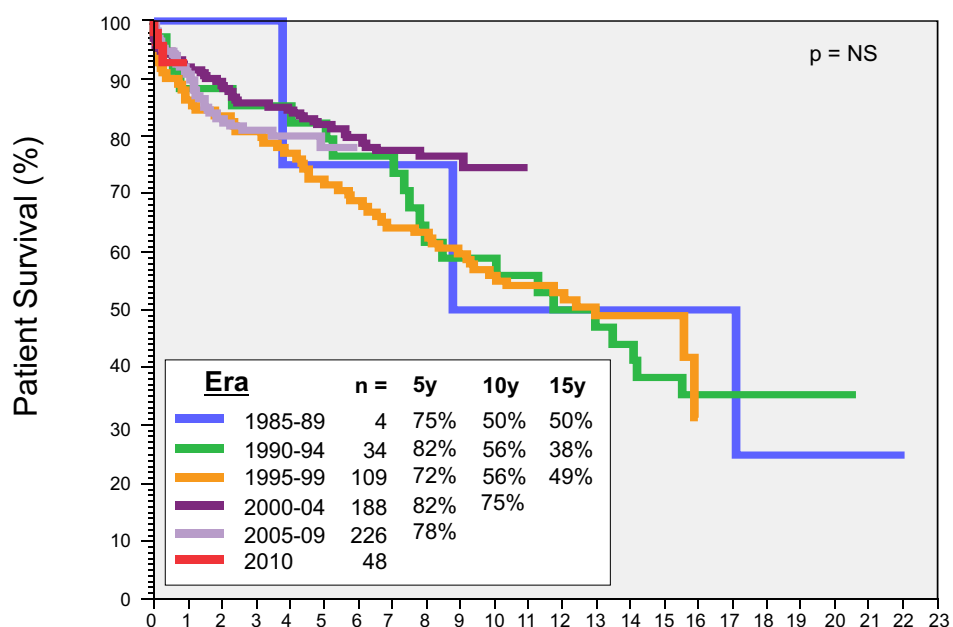
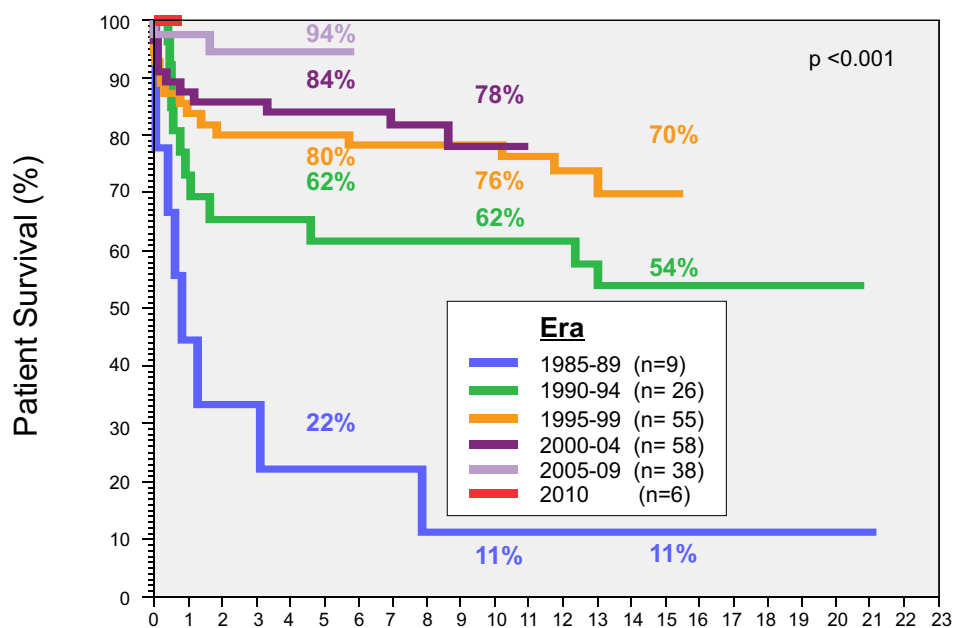


### (3) Paediatric recipients [excluding FHF] - n=571



### (4) Fulminant hepatic failure n=340



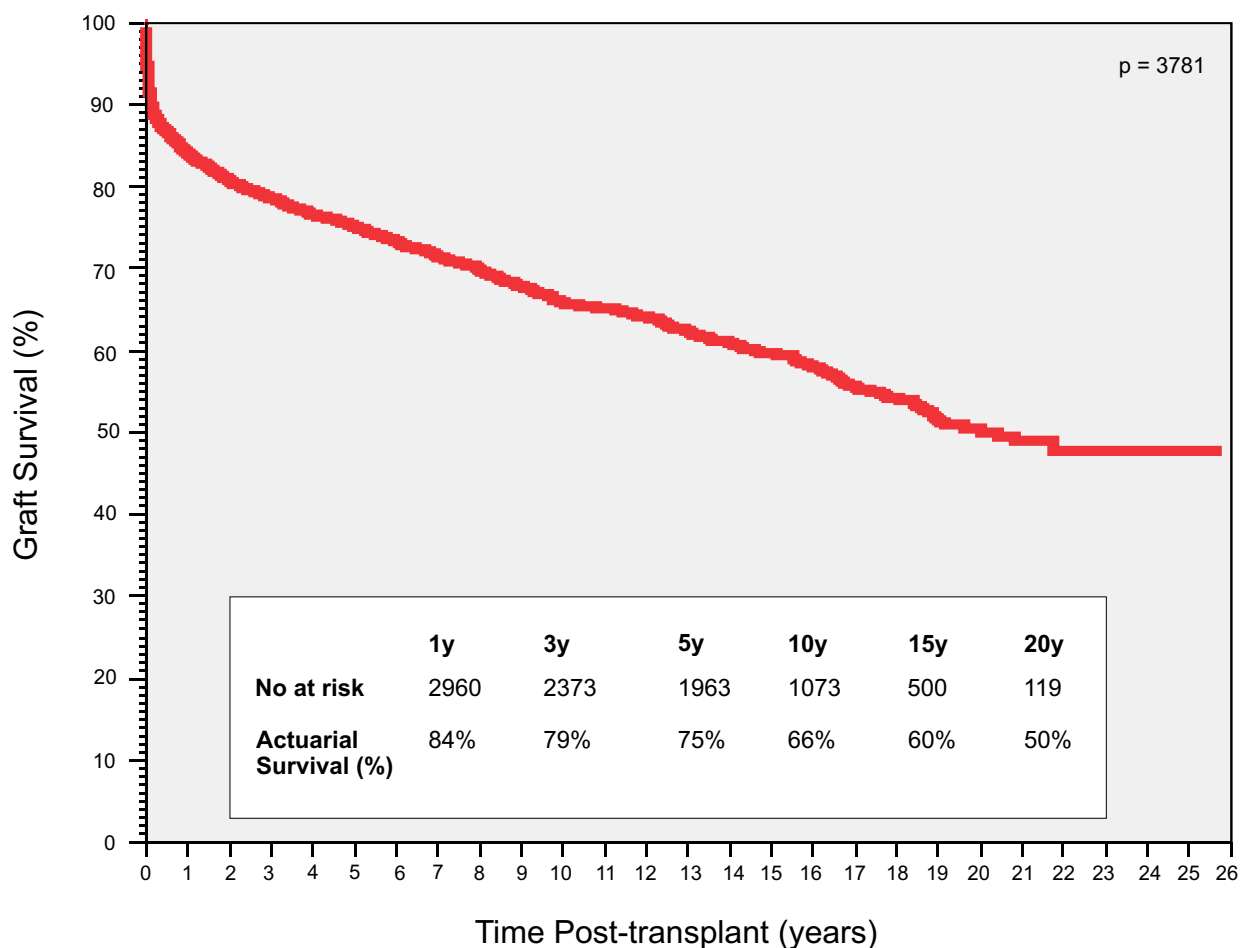




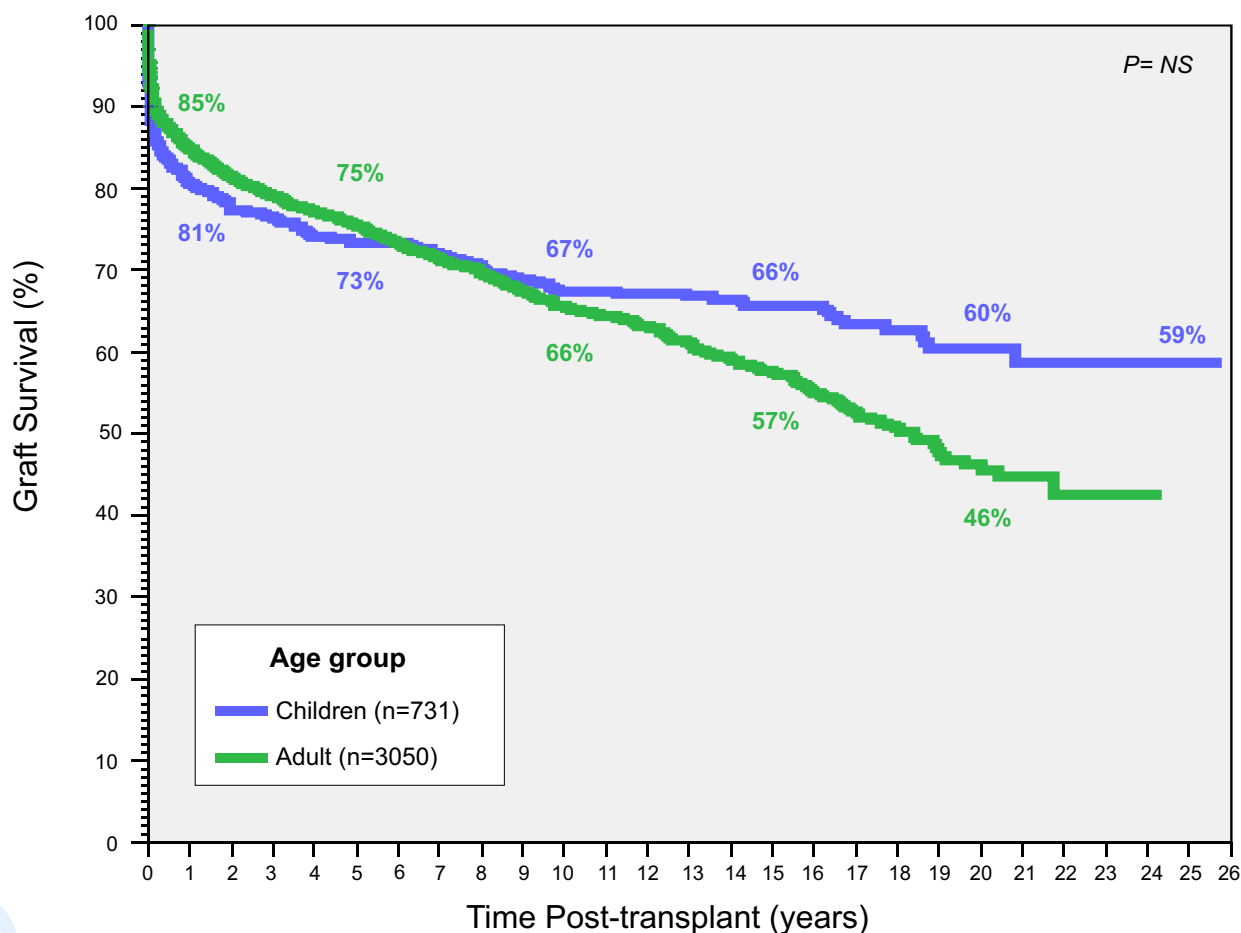
# Section 4

## Graft Outcome





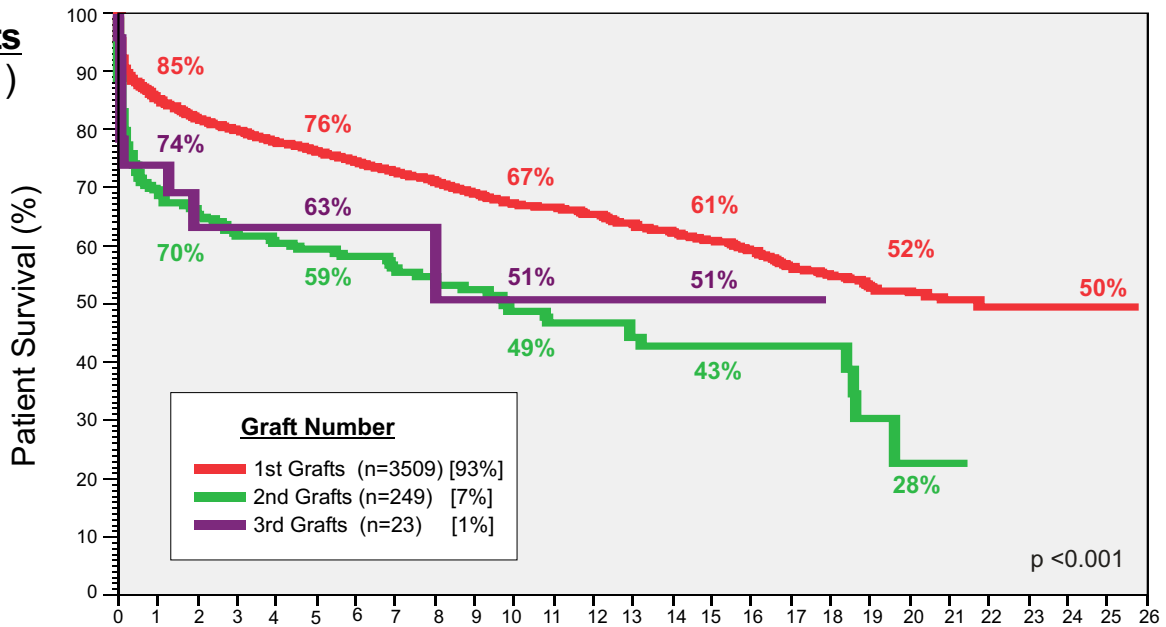
## Graft Survival by Age Group



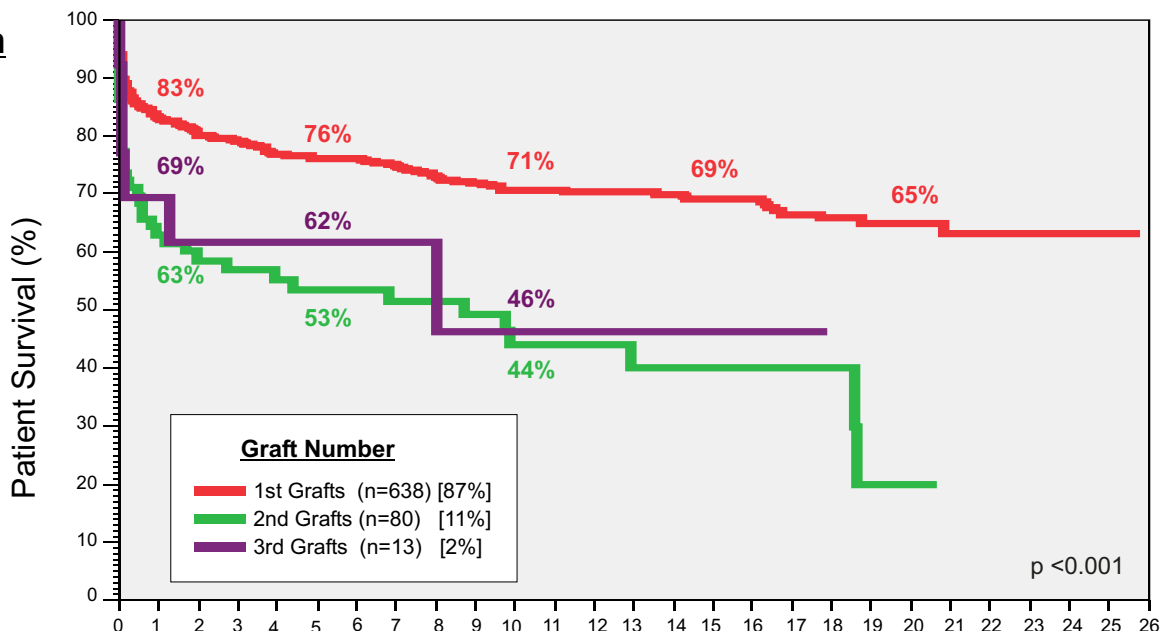




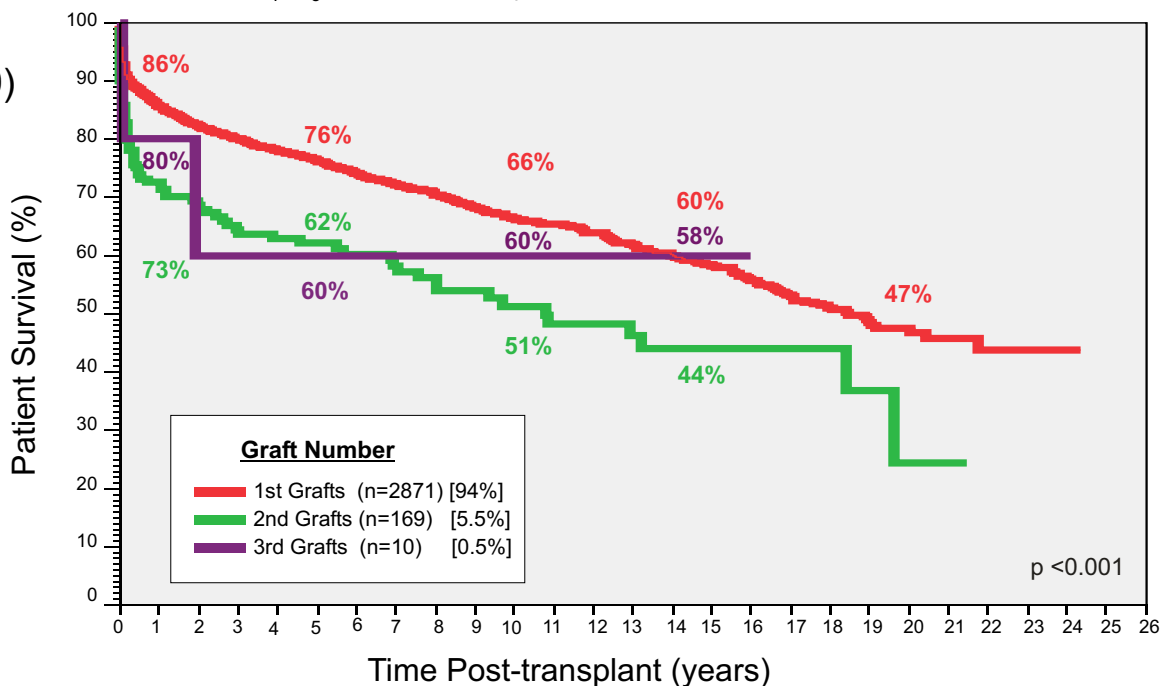
## All Grafts (n= 3781)



## Children (n= 731)

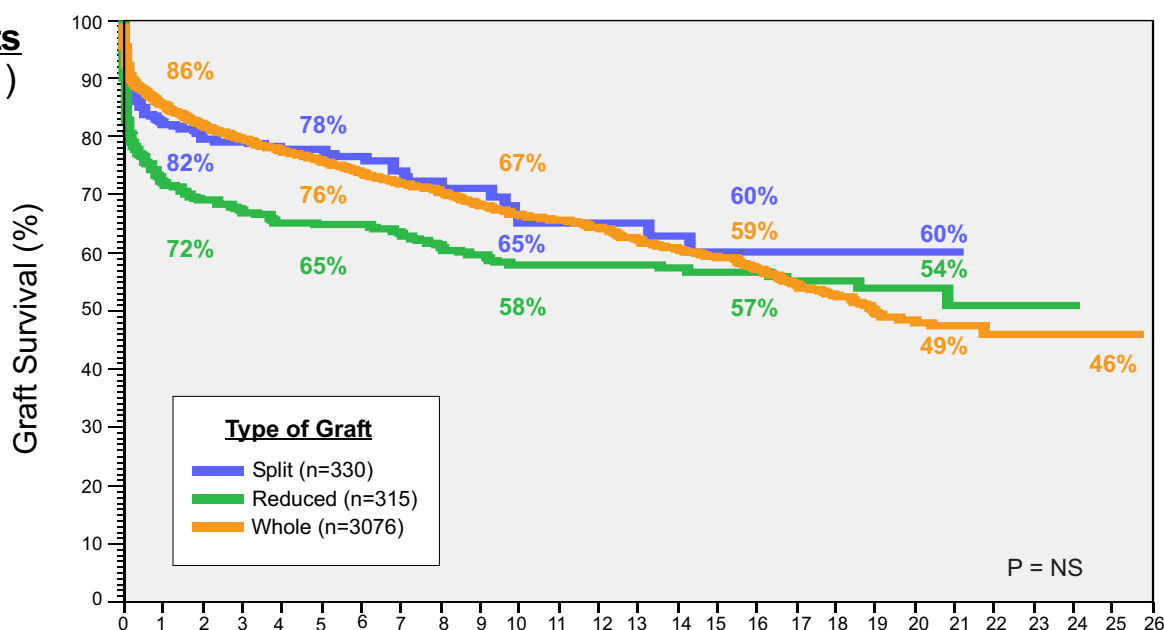


## Adult (n= 3050)

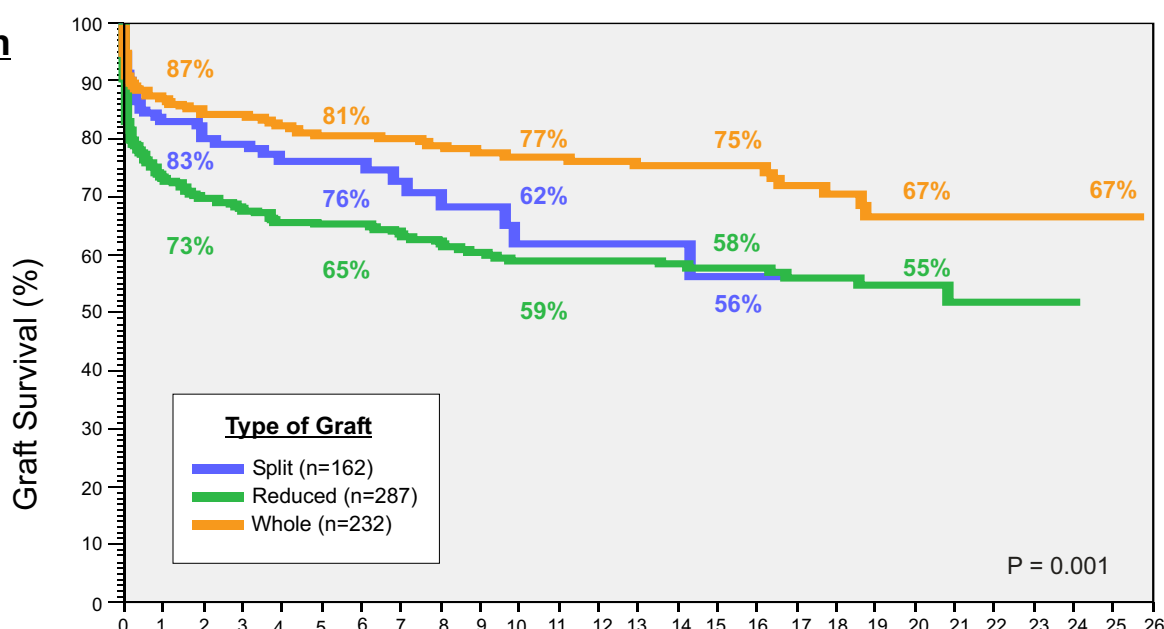




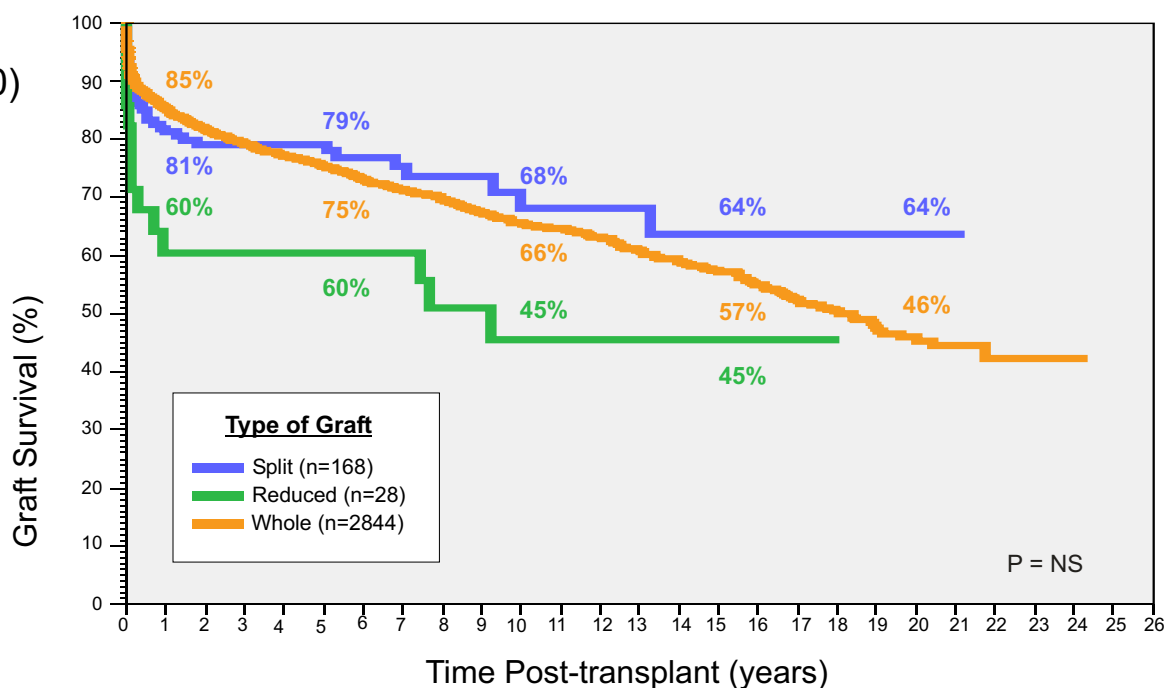
## All Grafts (n= 3721)



## Children (n= 681)

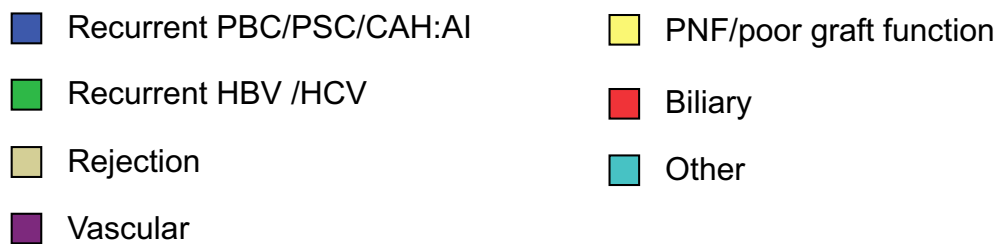
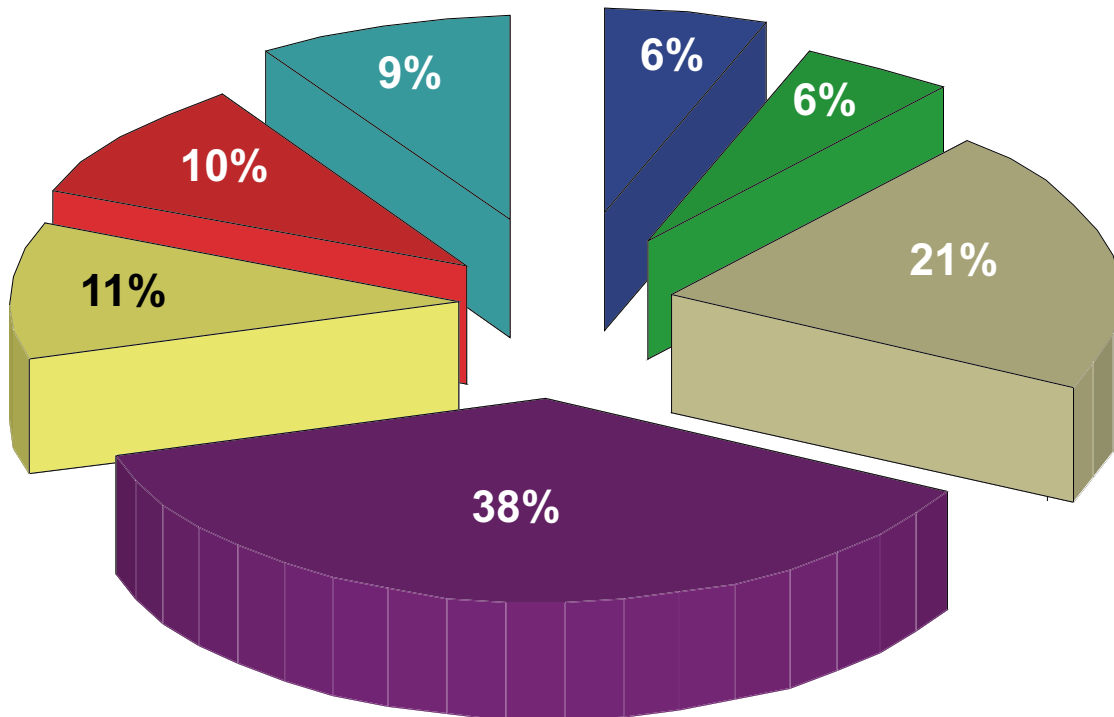


## Adult (n= 3040)



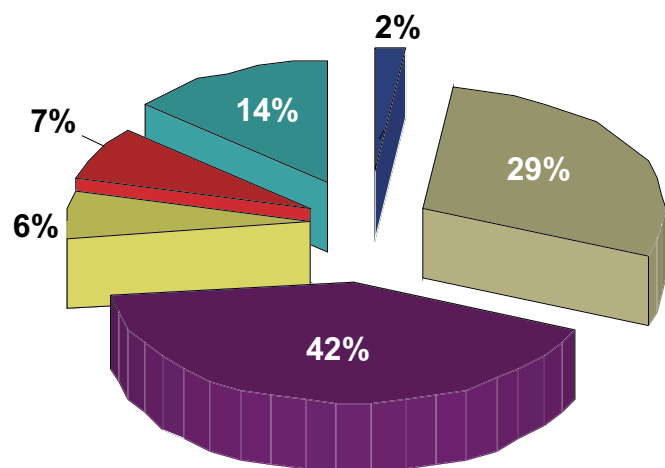
## Indication for Retransplantation

n = 272 (249 2nd grafts, 23 3rd grafts)

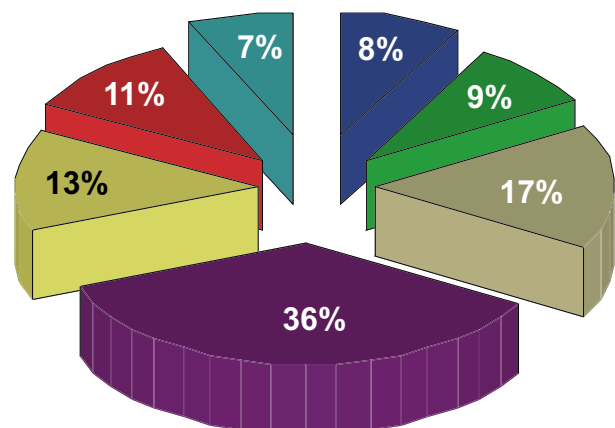


## Age Group

### Children

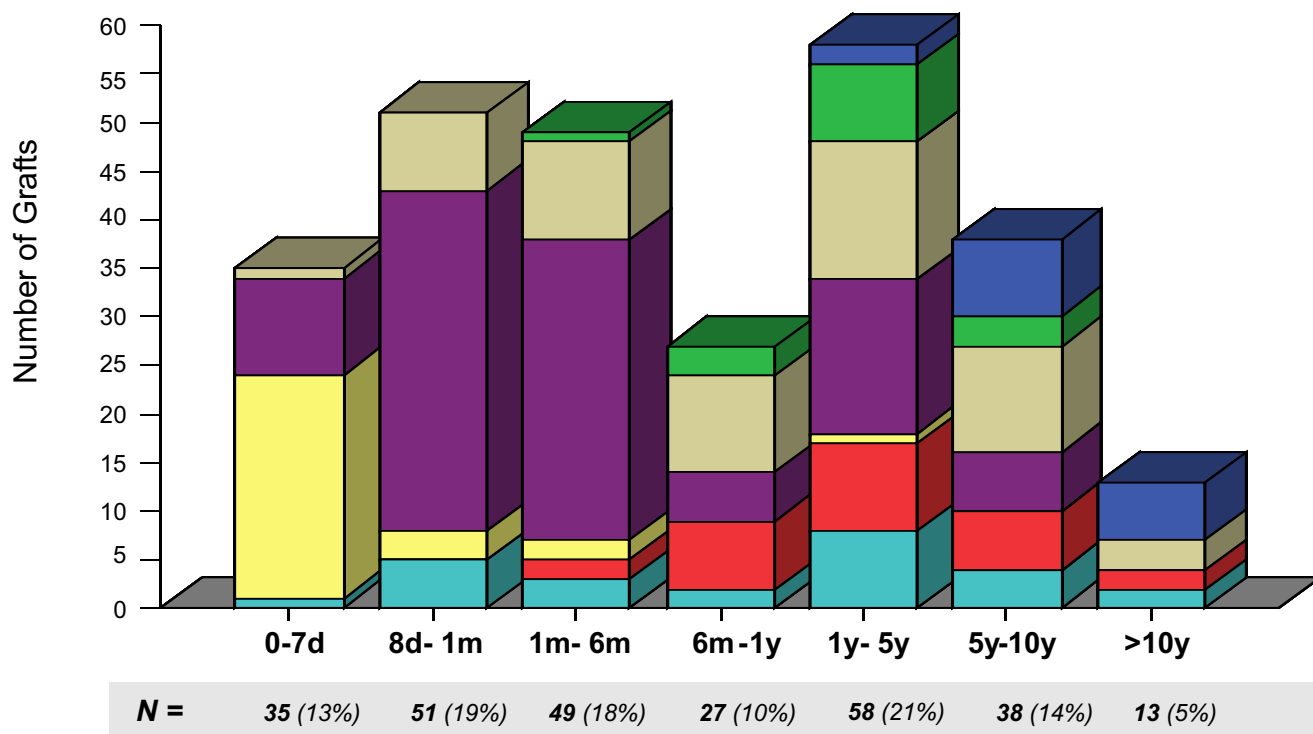


### Adults

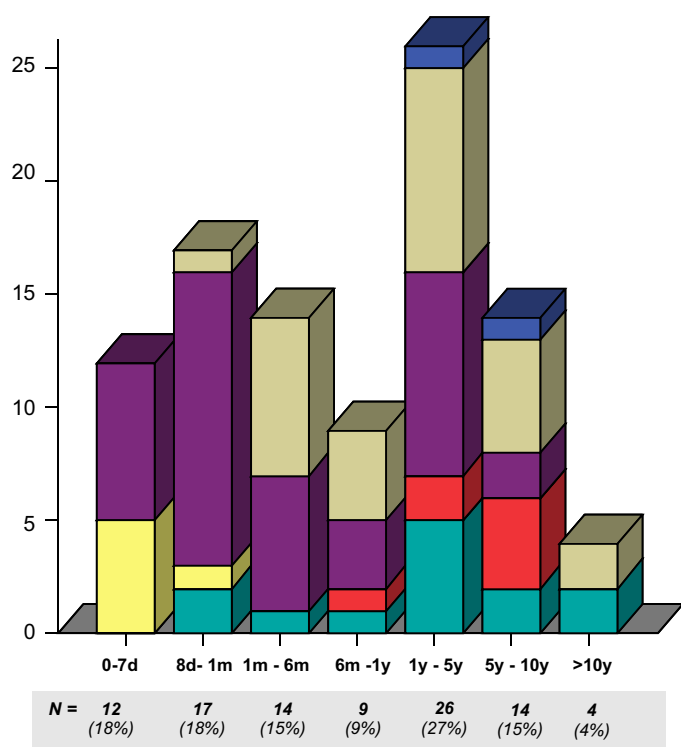


# Indication for Retransplantation

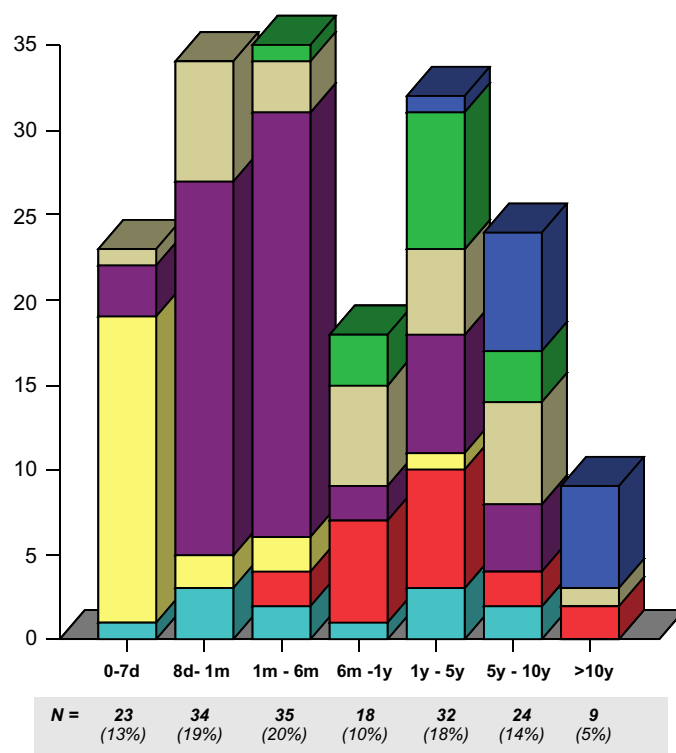
n = 272 (249 2nd grafts, 23 3rd grafts)



## Children (n=96)



## Adults (n=175)





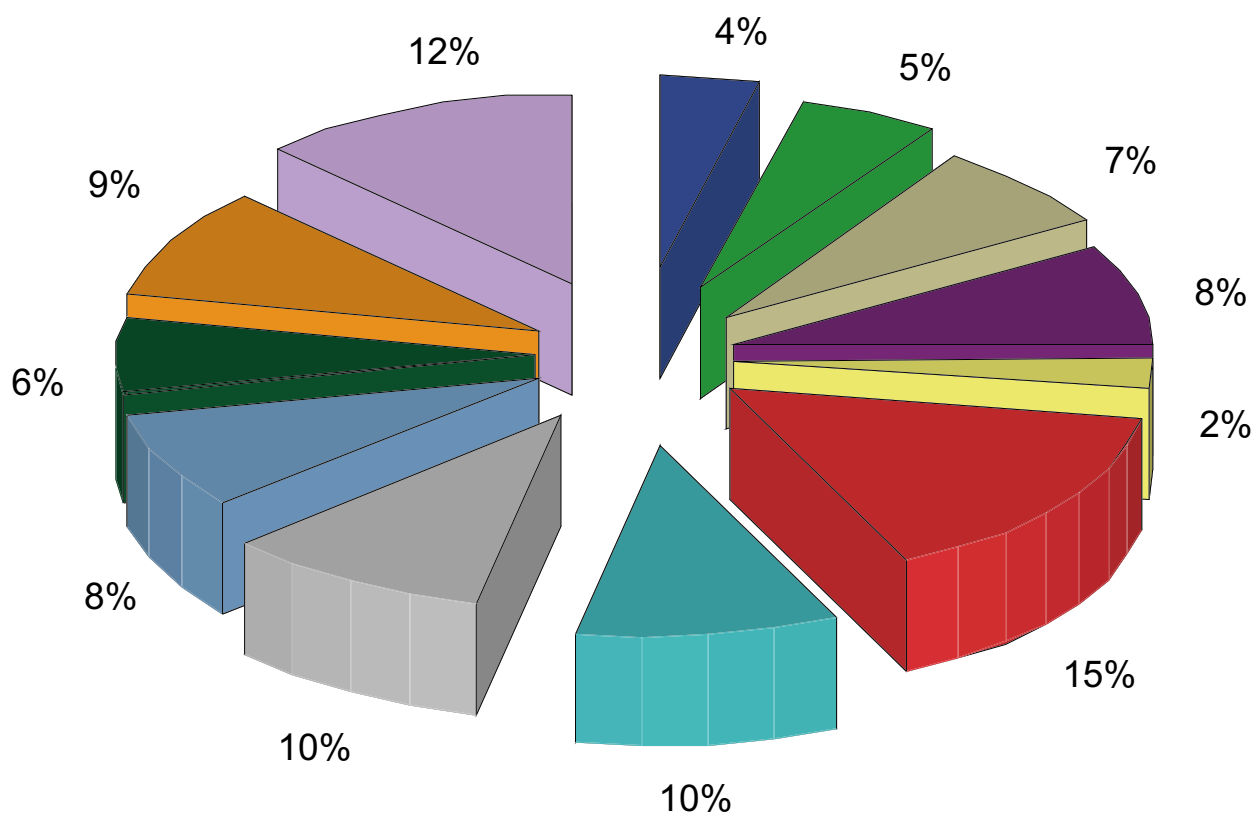
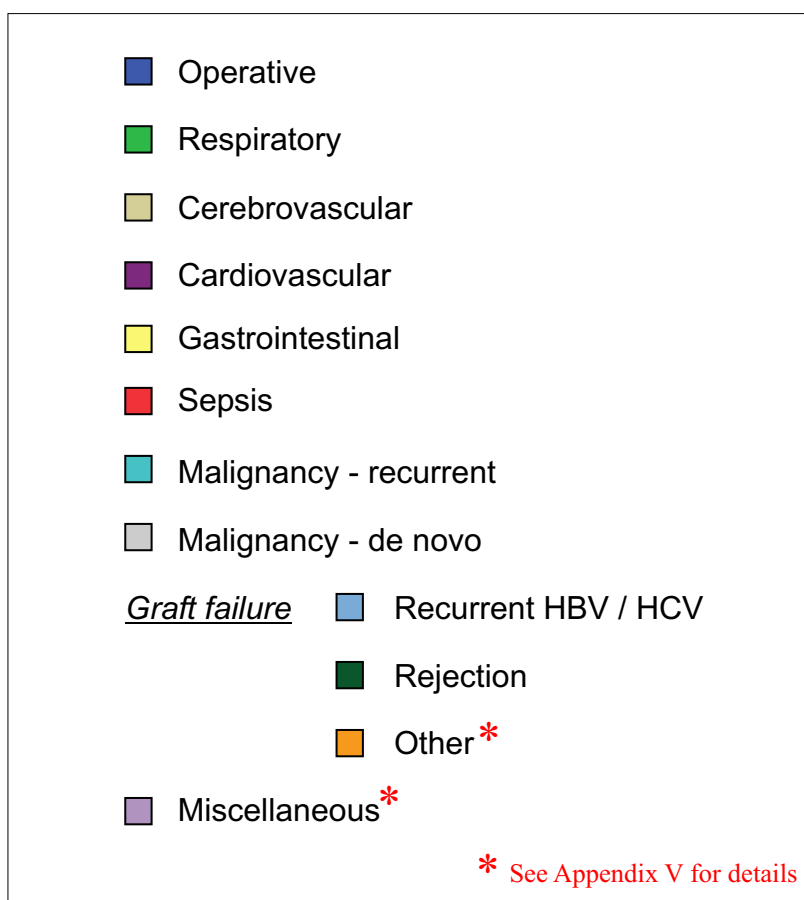
# Section 5

## Cause of Patient Death

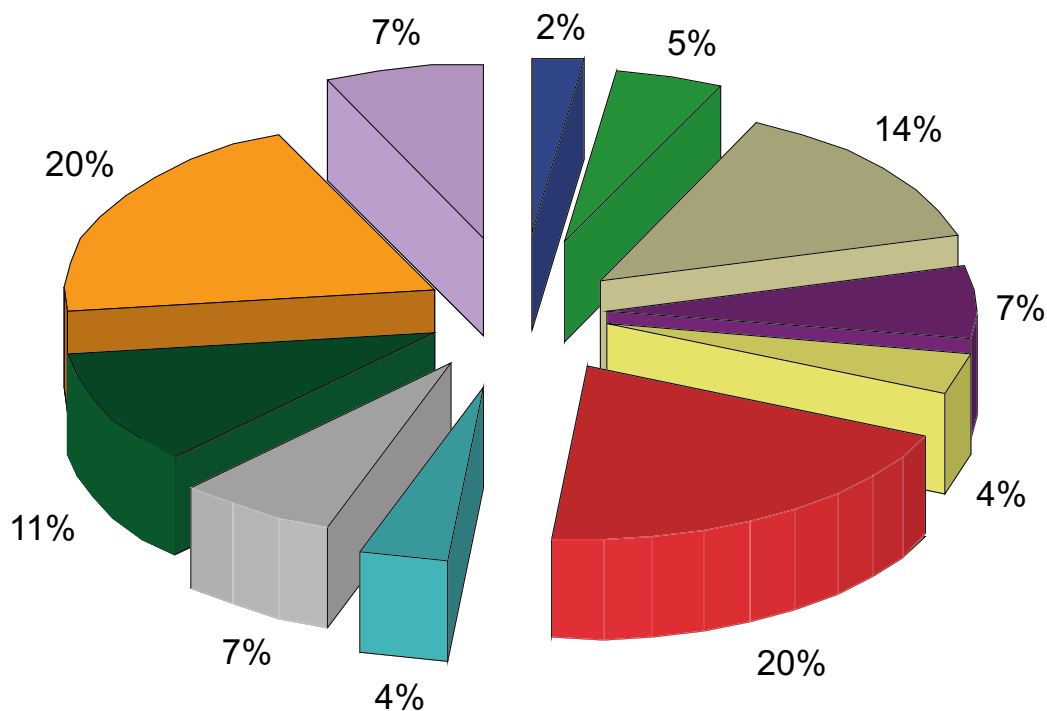




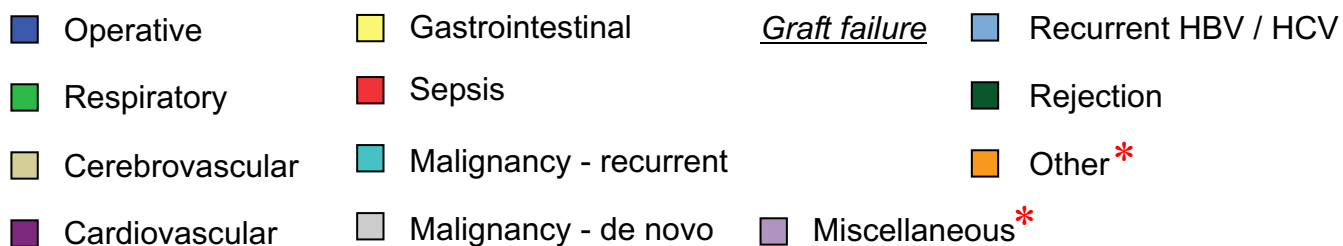
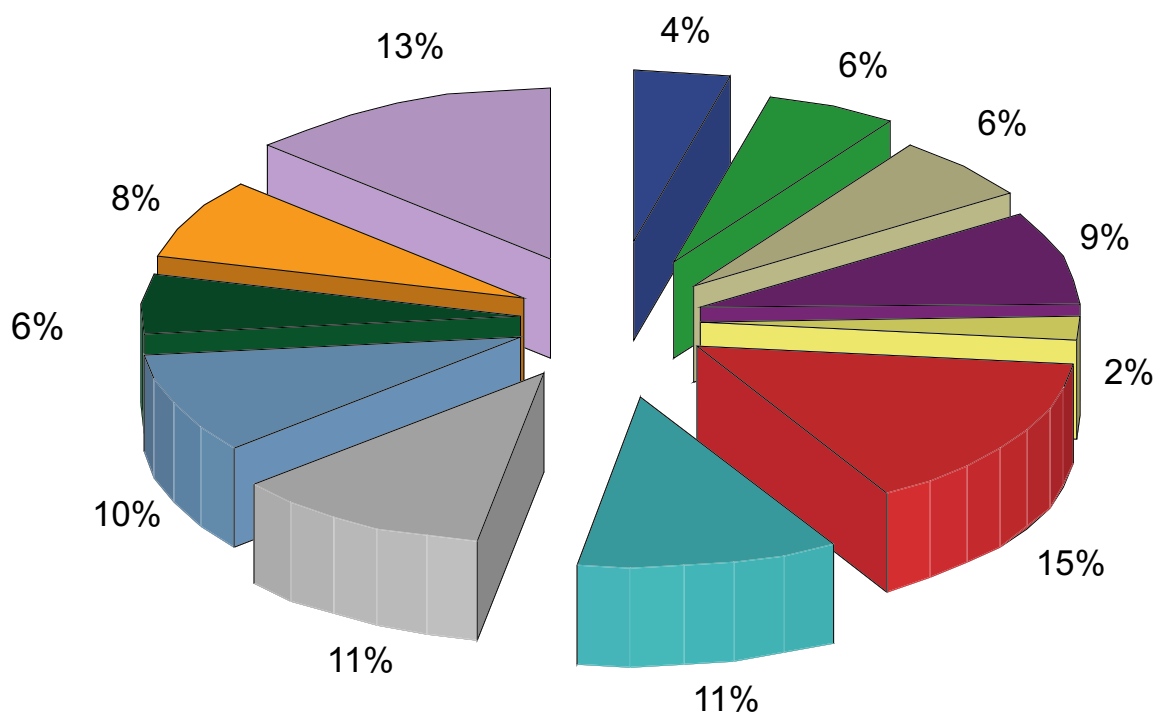
## All Patients n = 924



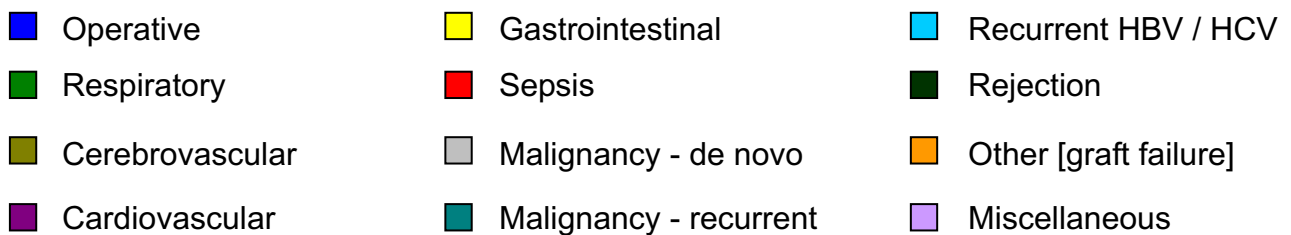
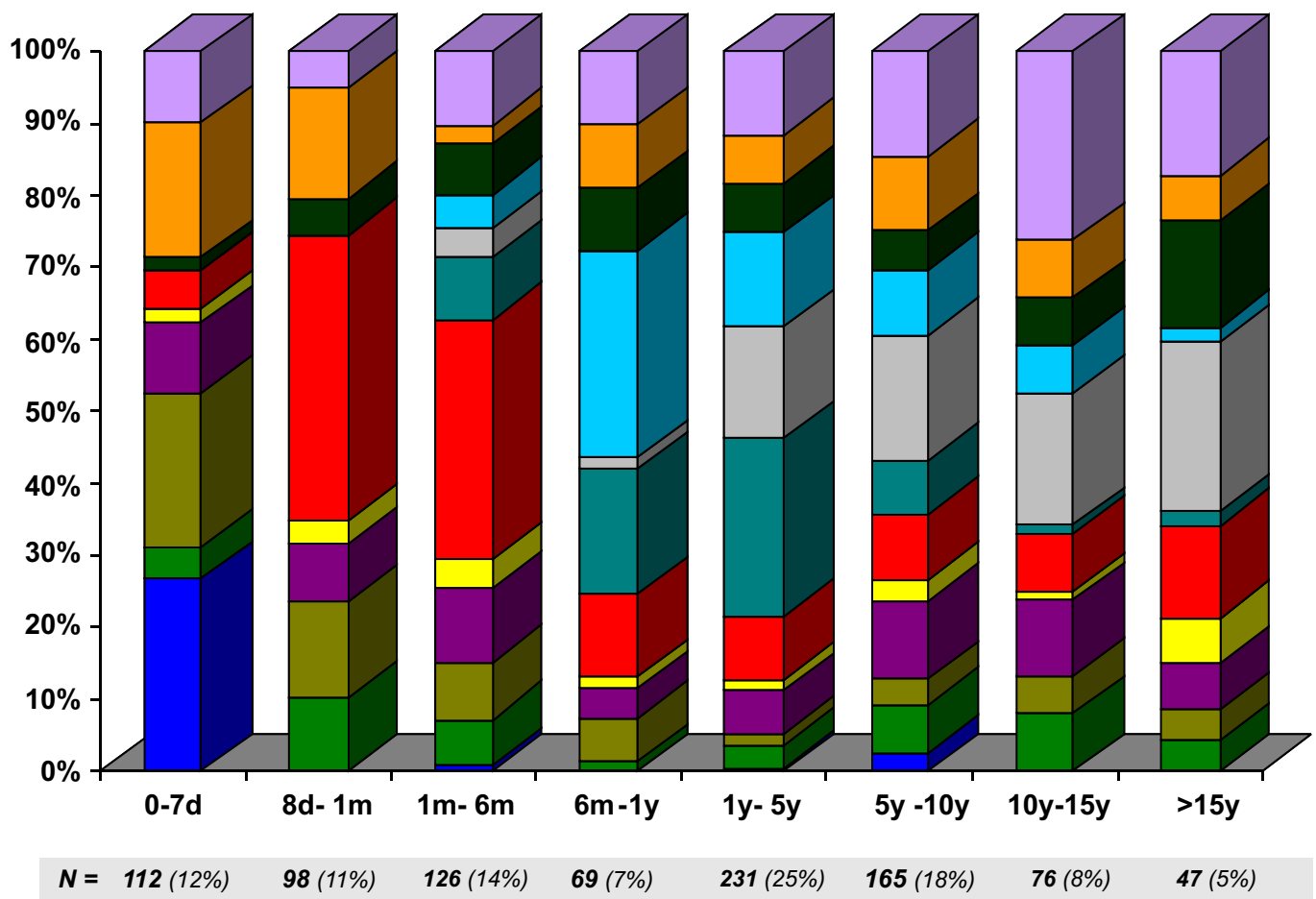
## Causes of Death in Children n = 130



## Causes of Death in Adult n = 794



\* See Appendix V for details



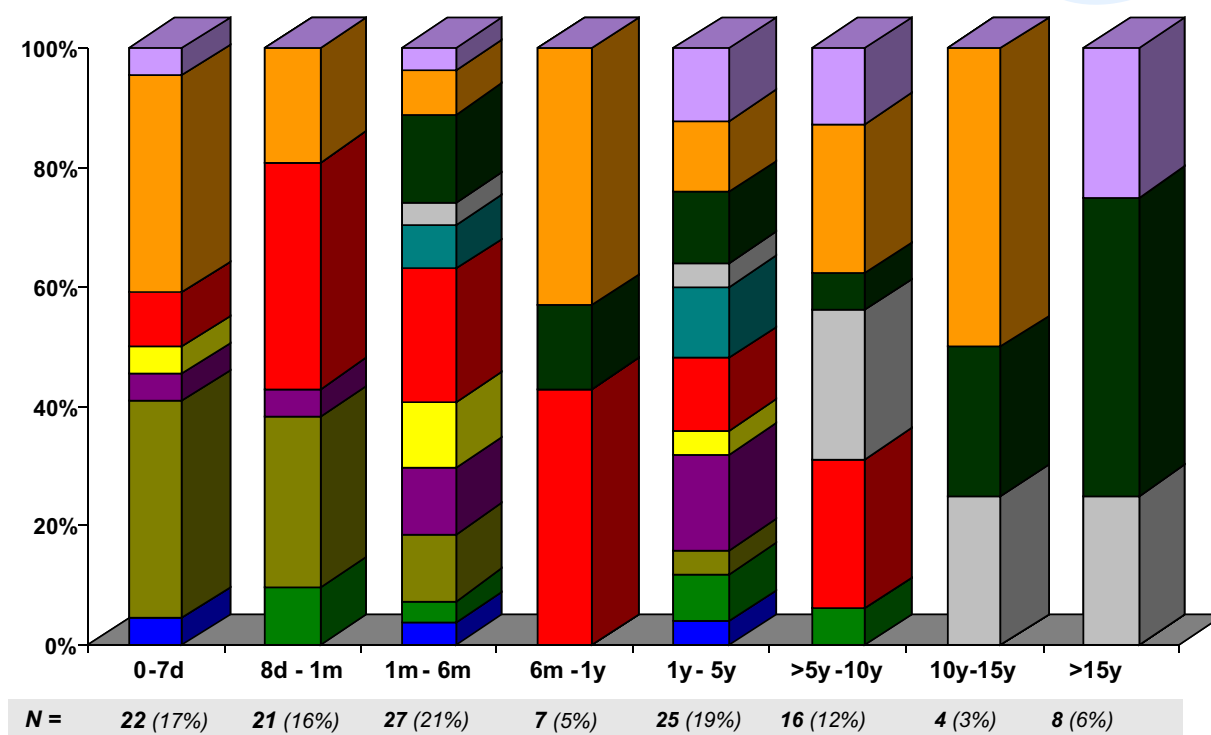


## Cause of Death by Time Post Transplant Children (n=130)

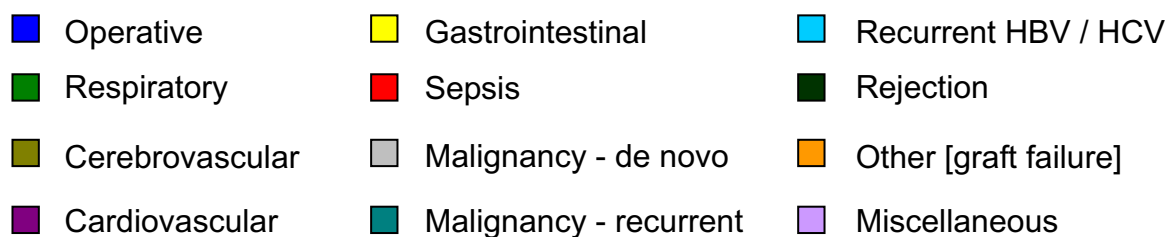
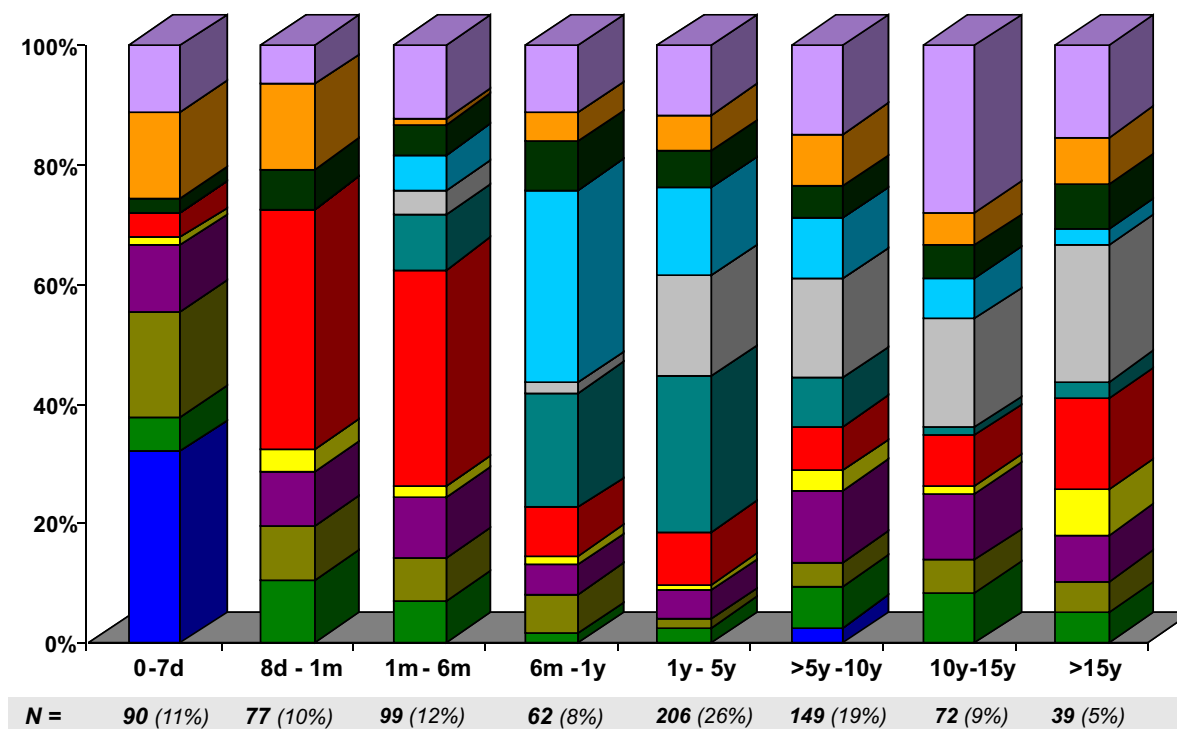
22<sup>nd</sup> ANZLT REGISTRY  
REPORT



CLICK HERE  
to go to Contents page



## Cause of Death by Time Post Transplant Adult (n=794)





# Section 6

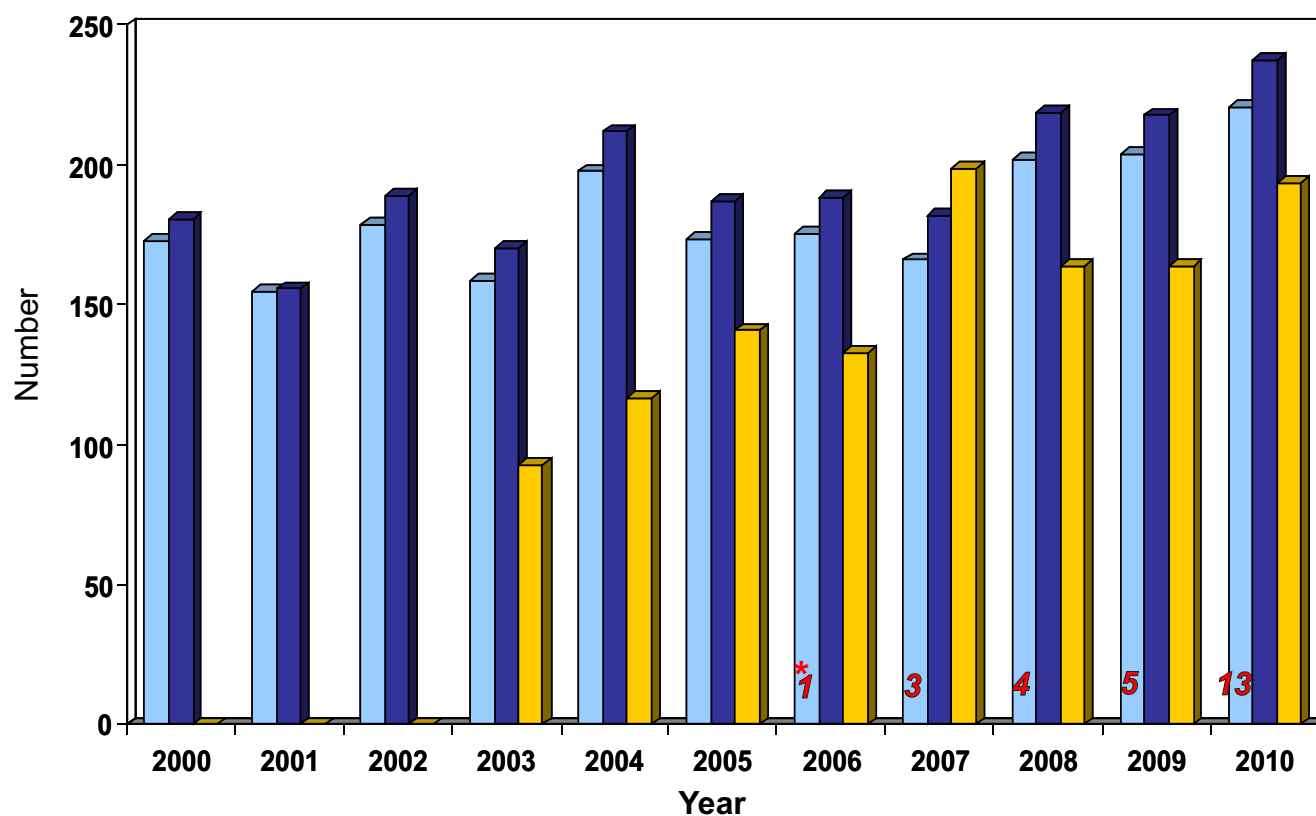
## Deceased Donor Information



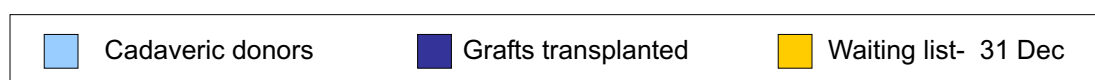


	QLD	NSW/ACT	VIC/TAS	SA/NT	WA	NZ	TOTAL
2000	26	51	26	24	12	34	173
2001	37	40	26	14	9	29	155
2002	34	42	38	24	11	30	179
2003	34	32/3	29/2	13	15	31	159
2004	30	49/4	35/1	26/1	17	35	198
2005	24	36/8	38/2	17/3	25	21	174
2006	28	34/3	39/6	25	17	24	176
2007	25	36/1	36	19/2	15	32	166
2008	33	40/3	41/5	31/1	25	23	203
2009	35	46/4	36/5	28/2	15	33	204
2010	30	55/8	53/6	18/2	17	32	221

## Grafts from deceased donors

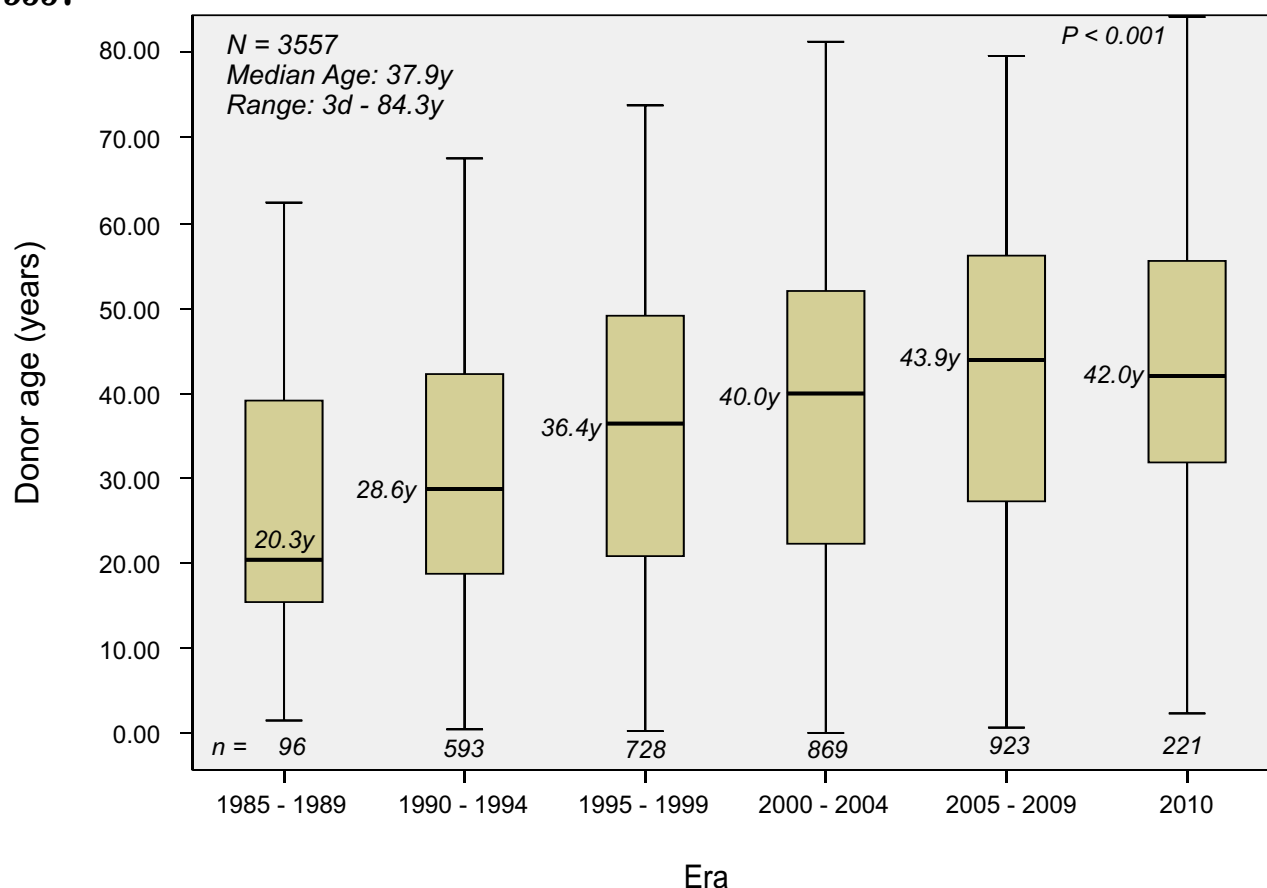


DCD donors\*



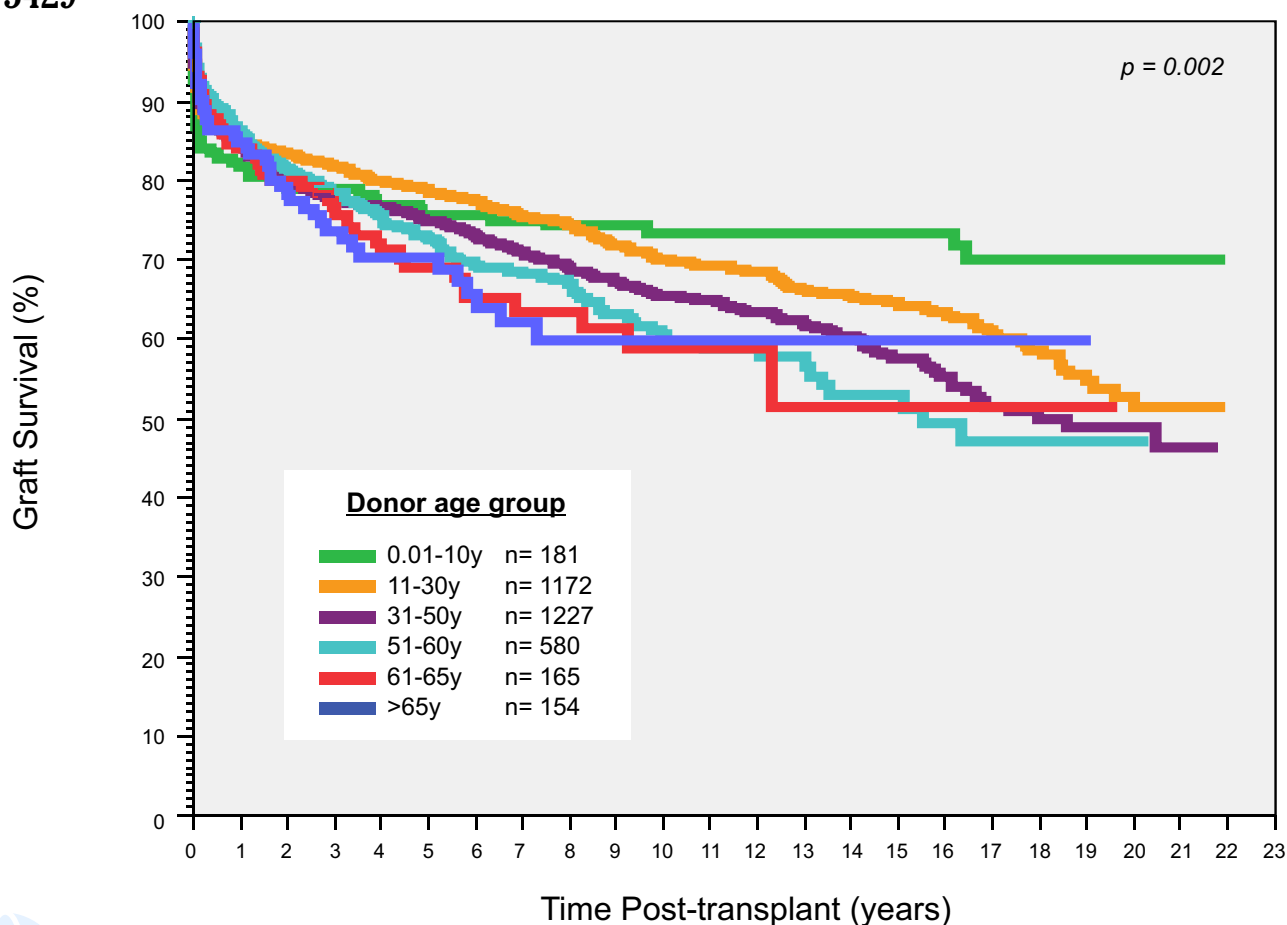
## Donor Age by Era

N = 3557



## Graft Survival by Donor Age

N = 3429





# Section 7

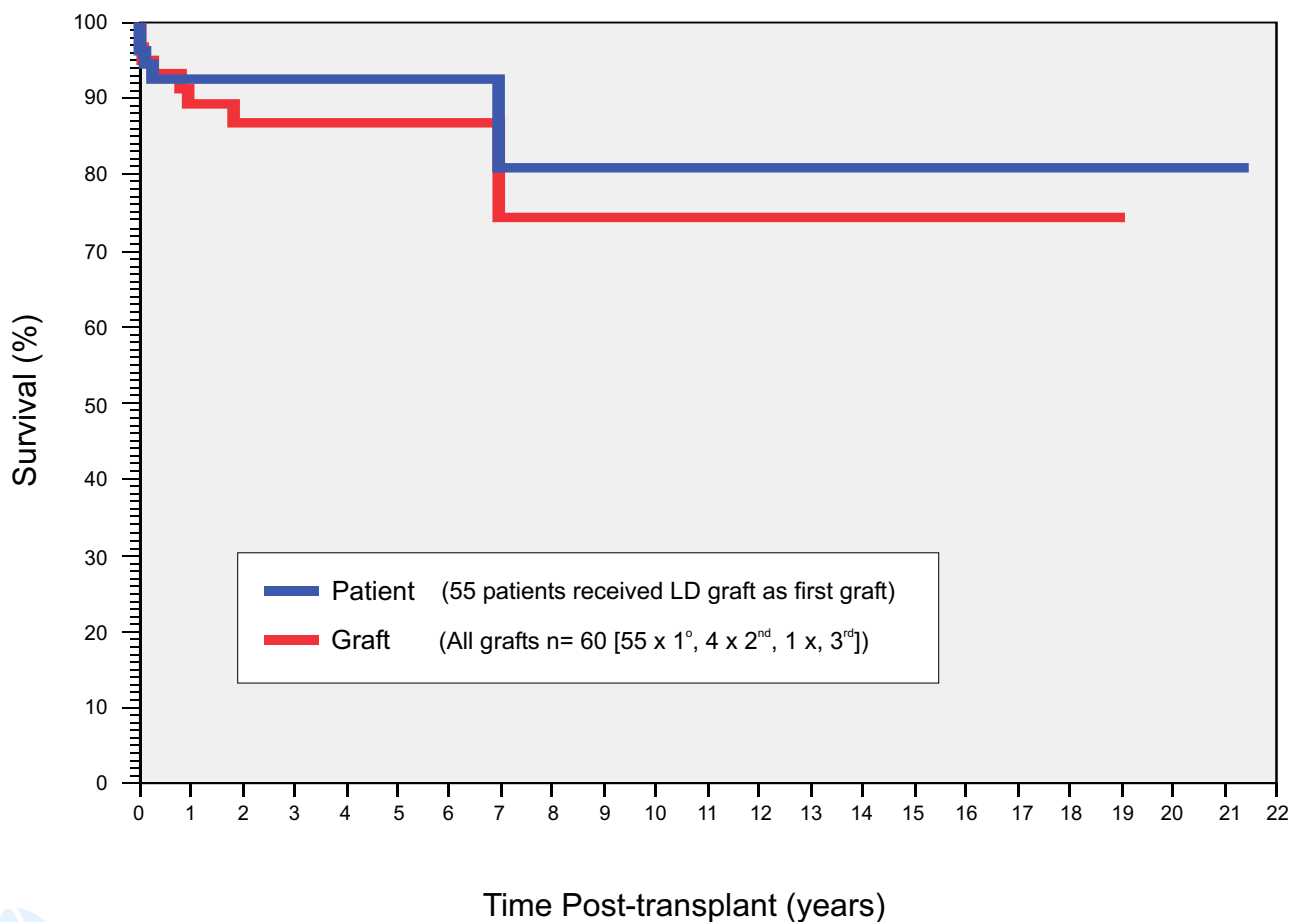
## Living Donor Transplantation





	Recipient Age Group		
	Child [n=49]	Adult [n=11] <sup>*</sup>	All [n=60]
<b>Donor gender</b>	-	-	-
Male	29	6	35
Female	20	5	24
<b>Donor age</b>	-	-	-
Median	36.2y	33.3y	34.2y
Range	23.0 - 54.5y	22.8 - 44.2y	22.8 - 54.5y
<b>Donor relationship</b>	-	-	-
Mother	13	-	12
Father	25	-	25
Son	-	3	3
Daughter	-	1	1
Grandmother	1	-	1
Grandfather	1	-	1
Sister	-	3	2
Brother	-	2	2
Aunt	5	-	5
Family friend	3	1	4
Cousin	1	-	1

\* 1 x whole liver domino transplant





# Section 8

## Waiting List



# Waiting List Activity

## [ Data 1/1/04 - 31/12/10]



Activity	2004	2005	2006	2007	2008	2009	2010		
Listed at 1 January	93	117	145	133	199	169	175	-	TOTAL 2010
New listings	279	292	259	338	290	335	-	335	
<b>TOTAL</b>	<b>372</b>	<b>409</b>	<b>404</b>	<b>471</b>	<b>489</b>	<b>504</b>	<b>175</b>	<b>335</b>	<b>510</b>
OUTCOME					OUTCOME				
<b>Transplant</b>	<b>214 [58%]</b>	<b>191 [47%]</b>	<b>194 [48%]</b>	<b>190 [40%]</b>	<b>229 [47%]</b>	<b>228 [46%]</b>	<b>94</b>	<b>154</b>	<b>248 [49%]</b>
<b>Delisted</b>	<b>41 [10%]</b>	<b>72 [18%]</b>	<b>77 [19%]</b>	<b>86 [18%]</b>	<b>96 [20%]</b>	<b>101 [20%]</b>	<b>34</b>	<b>34</b>	<b>68 [13%]</b>
Died on list	14	26	18	35	48	32	3	9	12
Too sick	8 } 6%	9 } 11%	13 } 10%	13 } 12%	14 } 14%	17 } 14%	4	10	12 } [8%]
Tumour progression	2	9	8	11	7	8	10	4	12
Improved	8	15	16	17	15	18	10	6	16
Other	9	13	22	10*	11	26	7	4	11*
Still listed at 31 Dec	117 [32%]	146 [35%]	133 [33%]	199 [43%]	169 [34%]	175 [34%]	47	147	194 (38%)

[\* Social/psychiatric, Moved Interstate, Alcohol, Malignancy, Alternate treatment]

## Outcome of Urgent Listing

OUTCOME	CATEGORY 1					
	2005 (n=14)	2006 (n=16)	2007 (n=18)	2008 (n=13)	2009 (n=17)	2010 (n=19)
TRANSPLANTED	4 } 64%	12 } 88%	10 } 67%	3 } 46%	9 } 65%	13 } 74%
IMPROVED	5 }	2 }	2 }	3 }	2 }	1 }
DIED / TOO SICK	5	2	6	7	6	5
OTHER TREATMENT	-	-	-	-	-	-

OUTCOME	CATEGORY 2					
	2005 (n=31)	2006 (n=26)	2007 (n=32)	2008 (n=24)	2009 (n=21)	2010 (n=30)
TRANSPLANTED	20 } 68%	21 } 88%	24 } 88%	20 } 83%	18 } 90%	23 } 93%
IMPROVED	1 }	2 }	4 }	1 }	1 }	5 }
DIED / TOO SICK	10	2	2	3	2	1 / 1
OTHER TREATMENT	-	1	-	-	-	-



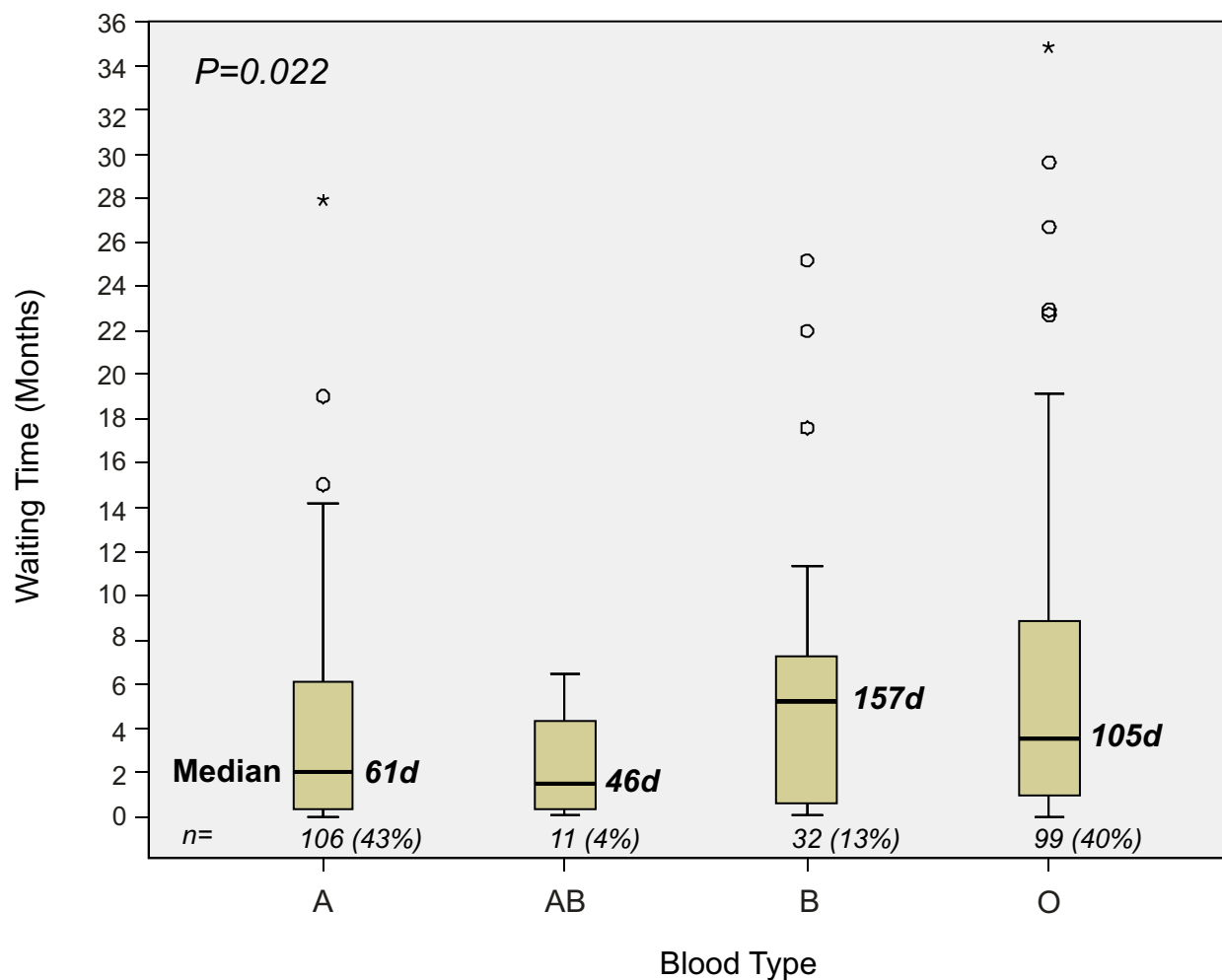


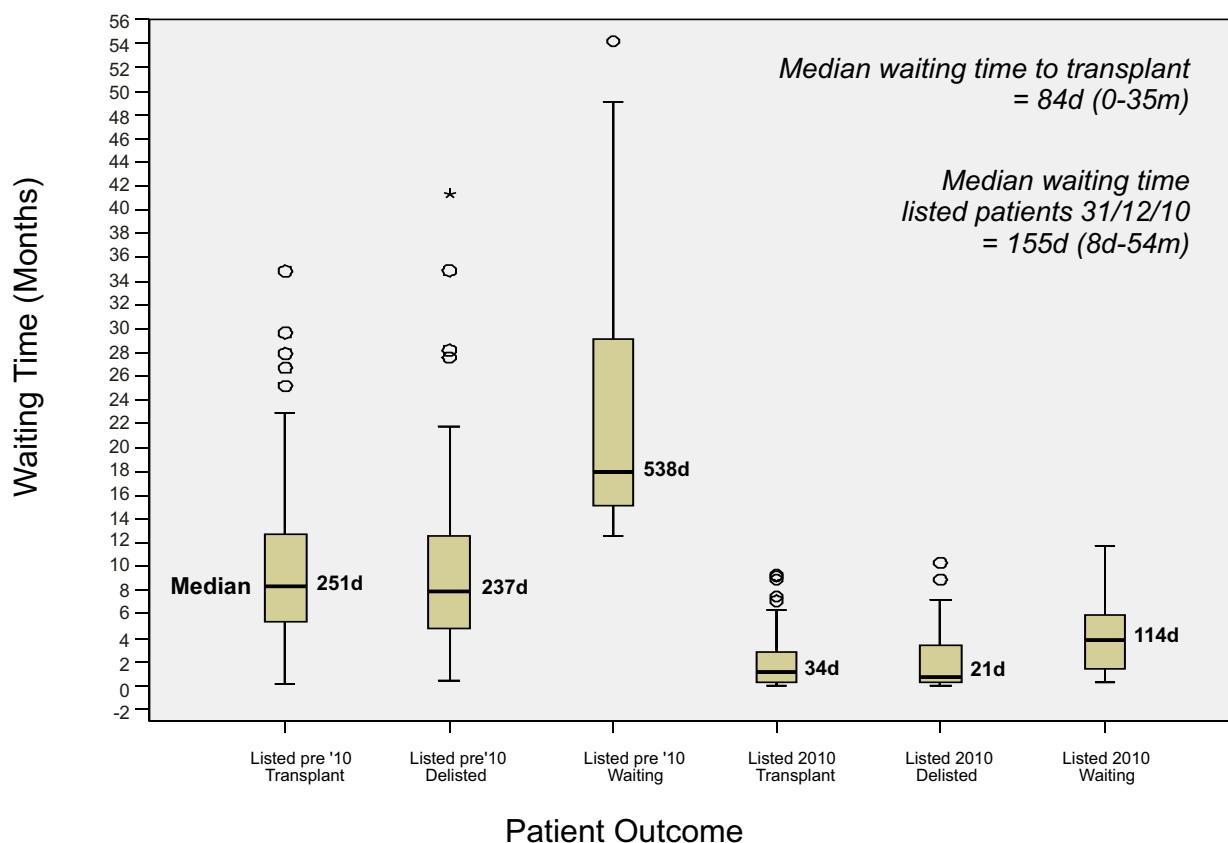
	Blood Group				
	A	O	B	AB	TOTAL
n=	213 (42%)*	204 (40%)	77 (15%)	16 (3%)	510
Not transplanted	107	105	45	5	262
Transplanted	106 (50%)**	99 (49%)	32 (42%)	11 (69%)	248

\* % of total number listed

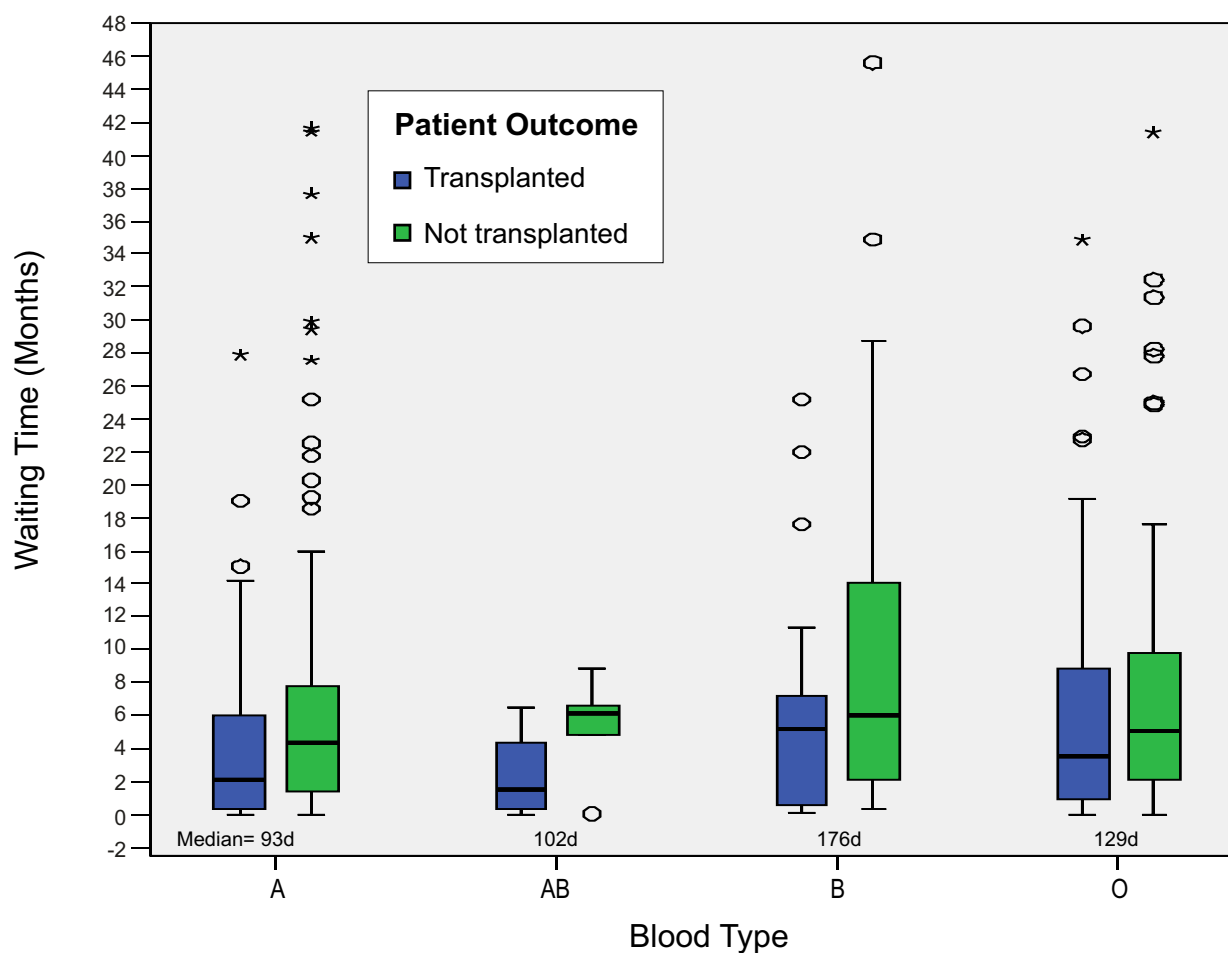
\*\* % of blood group

## Waiting Time to Transplant 2010





## Waiting Time by Outcome & Blood Group





# Section 9

## Liver Transplantation and Cancer



# Cancer in Liver Transplant Recipients

N = 3510



At Tx	
Tx for Liver Ca	234 (7%)
Liver Ca as a Secondary Diagnosis	390 (11%) 392 Ca
Total	624* (17%)
Post Tx	
Recurrent Liver Ca	112 (3% of all pts, 18% pts with Ca at Tx)
De Novo Ca	222 (6%) 237 Ca
Skin Ca	455 (13%)
Total	791 (23%)
Multiple Ca types	160 (5% of all pts)
Pre-Tx cancer developed de novo non skin cancer	32 (5% of pts with Ca at Tx)
Transferred from Donor	2
Developed non skin Ca < 90days	9

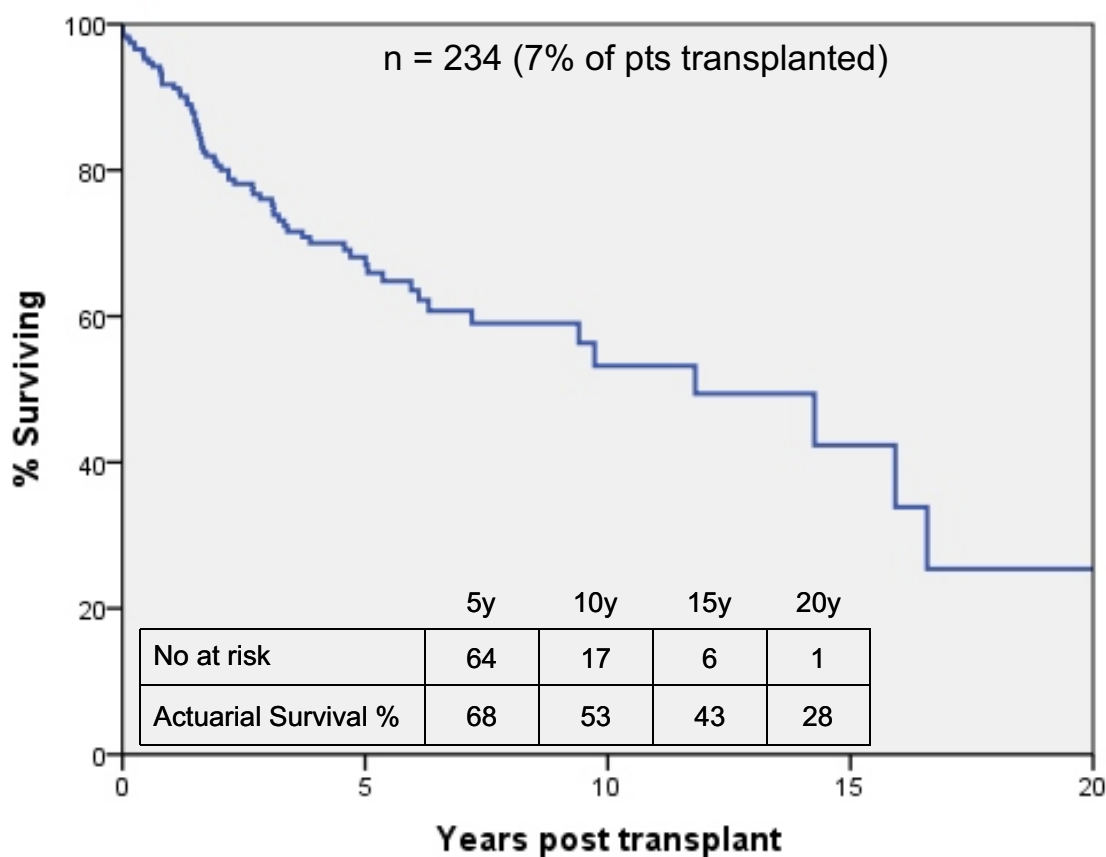
\* 2 pts had primary and a secondary liver cancer; 2 pts had multiple secondary liver cancers

## Liver Cancer as Primary Diagnosis

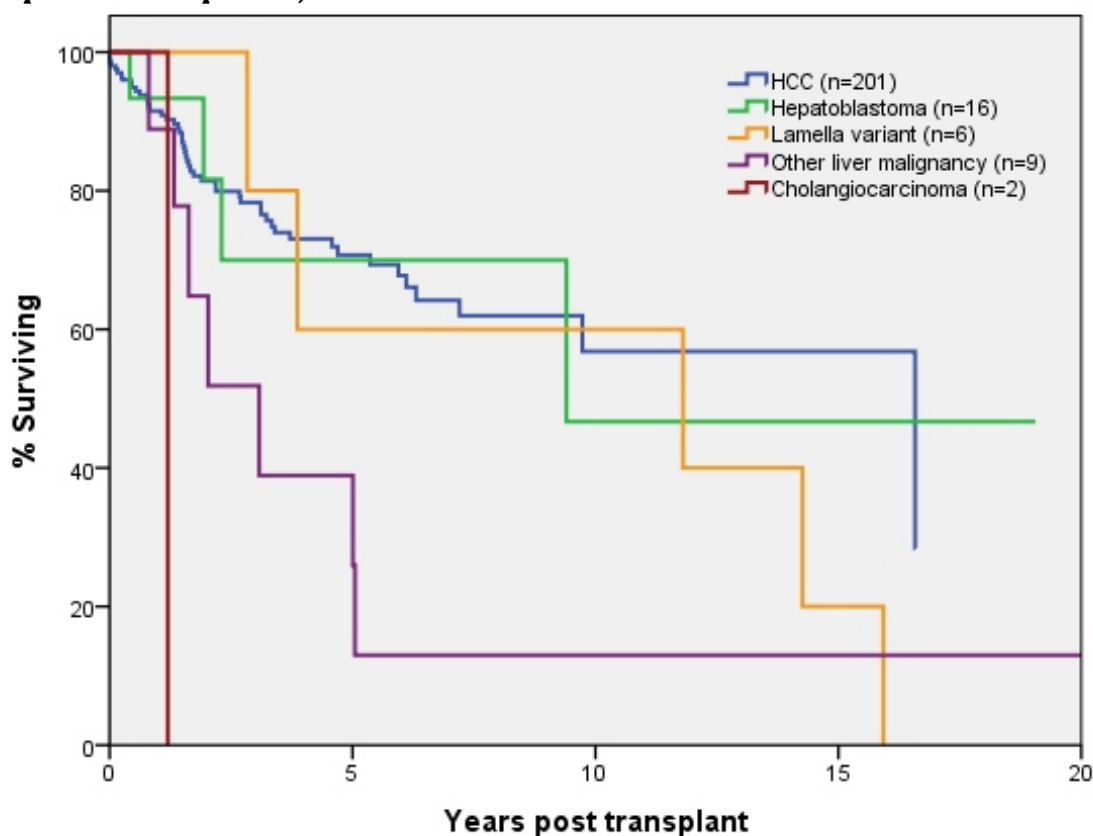
N= 3510

TYPE OF CA	No	DIED	DIED OF THIS CA
HEPATOCELLULAR CA	201	50	27 (13%)
HEPATOBLASTOMA	16	4	3 (19%)
CARCINOID	4	4	4 (100%)
EPITHELOID HAEMANGIOENDOTHELIOMA	2	0	0
CHOLANGIOCARCINOMA	2	1	1 (50%)
ANGIOSARCOMA	1	1	1 (100%)
GASTRINOMA	1	1	1 (100%)
PANCREATIC ISLET CELL	1	1	1 (100%)
LAMELLA VARIANT	6	5	2 (33%)
TOTALS	234 (7% of pts)	63 (26% of those with PCa)	40 (17% of those with PCa)

Overall Survival  
Primary Liver Cancer  
N = 234 (7% of patients transplanted)



Overall Survival  
Primary Liver Cancer  
N = 234 (7% of patients transplanted)



# Primary Liver Cancer

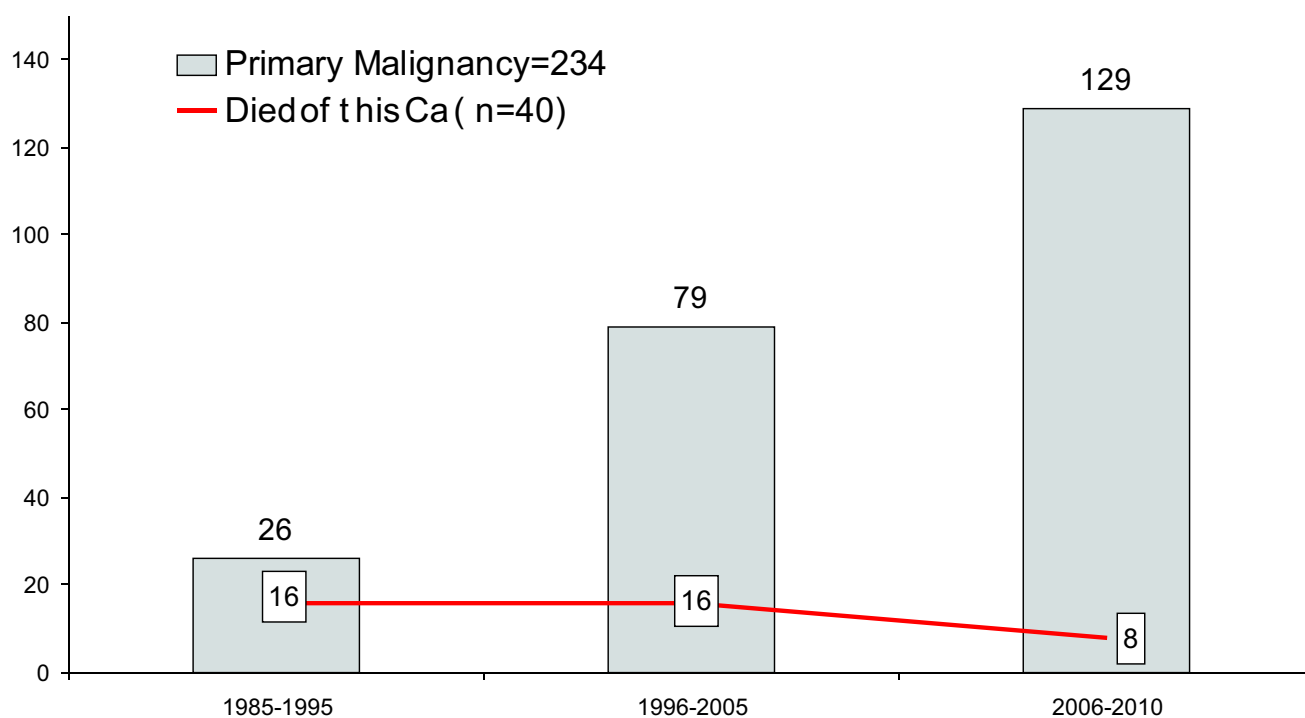
## Actuarial Survival Summary

n = 3510



		1yr	5yr	10yr	15yr
<b>HCC (n=201)</b>	n	153	55	11	3
	%	81	68	58	58
<b>Hepatoblastoma (n=16)</b>	n	10	3	2	1
	%	82	70	46	46
<b>Other (n=13)</b>	n	8	3	1	1
	%	89	33	11	11
<b>Lamella Variant (n=6)</b>	n	5	3	3	1
	%	100	60	60	0
<b>CC (n=2)</b>	n	1	0		
	%	100			

## Primary Liver Cancer Incidence and Mortality



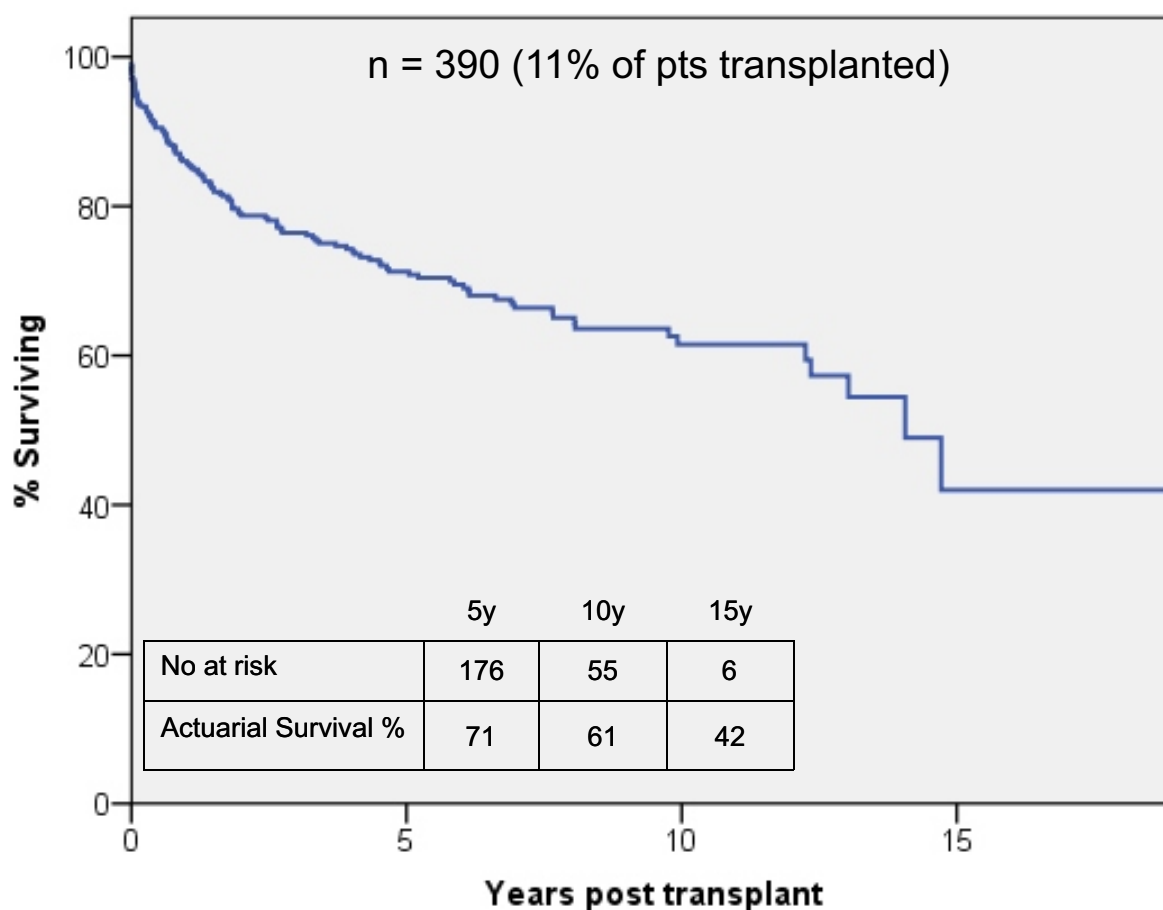
## Liver Cancer as a Secondary Diagnosis N=3510



	No	Died	Died of This Cancer
HEPATOCELLULAR CA*	346	95	28 (8%)
CHOLANGIO CA	32	21	14 (44%)
ADENOCARCINOMA	4	3	1(25%)
HEPATOBLASTOMA*	3	1	0
ANGIOSARCOMA	1	1	1(100%)
EPITHELOID HAEMANGIOCA	1	0	0
LAMELLA VARIANT	3	1	1(33%)
<b>Total</b>	<b>392* in 390pts (11%)</b>	<b>122 (31% of pts with SCa)</b>	<b>45 (12% of pts with SCa)</b>

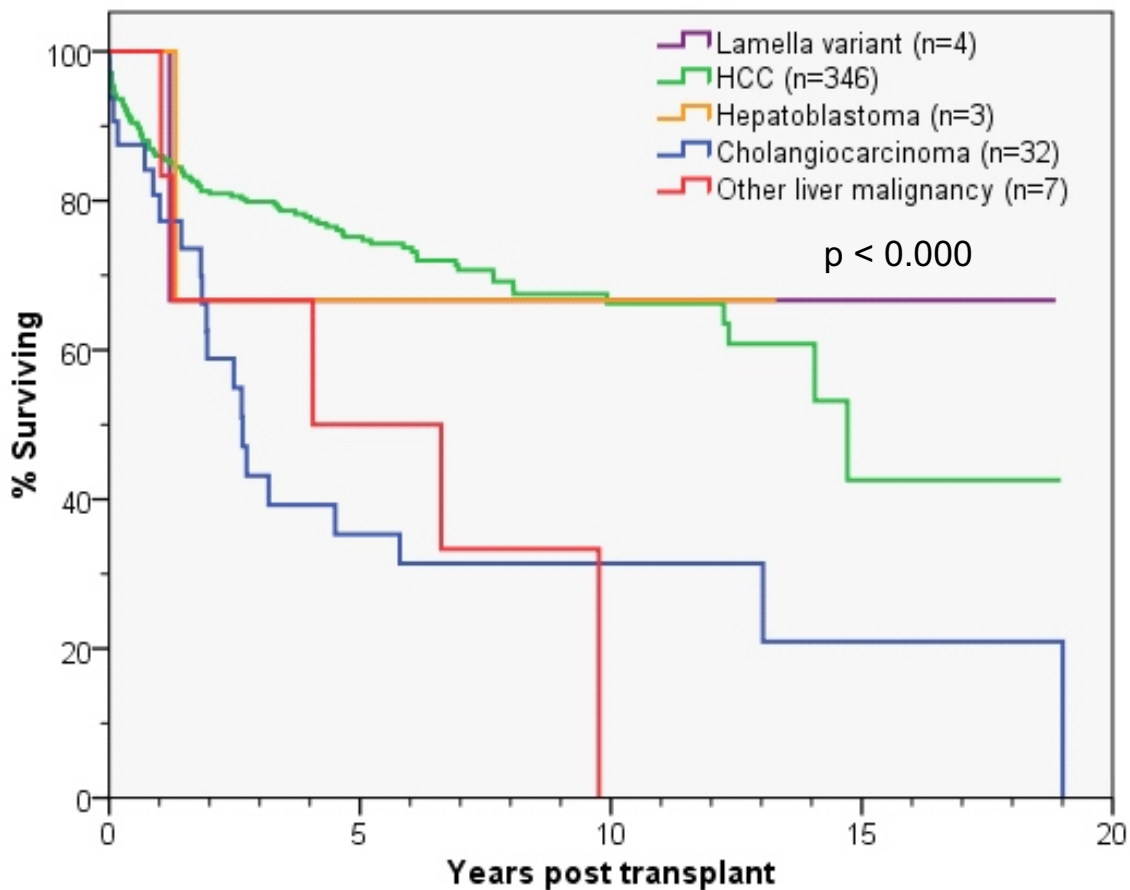
\* 2 patients had 2 secondary cancers

## Overall Survival Liver Cancer as a Secondary Diagnosis



# Liver Cancer as a Secondary Diagnosis

N = 3510



## Secondary Liver Cancer

### Actuarial Survival Summary

N=3510

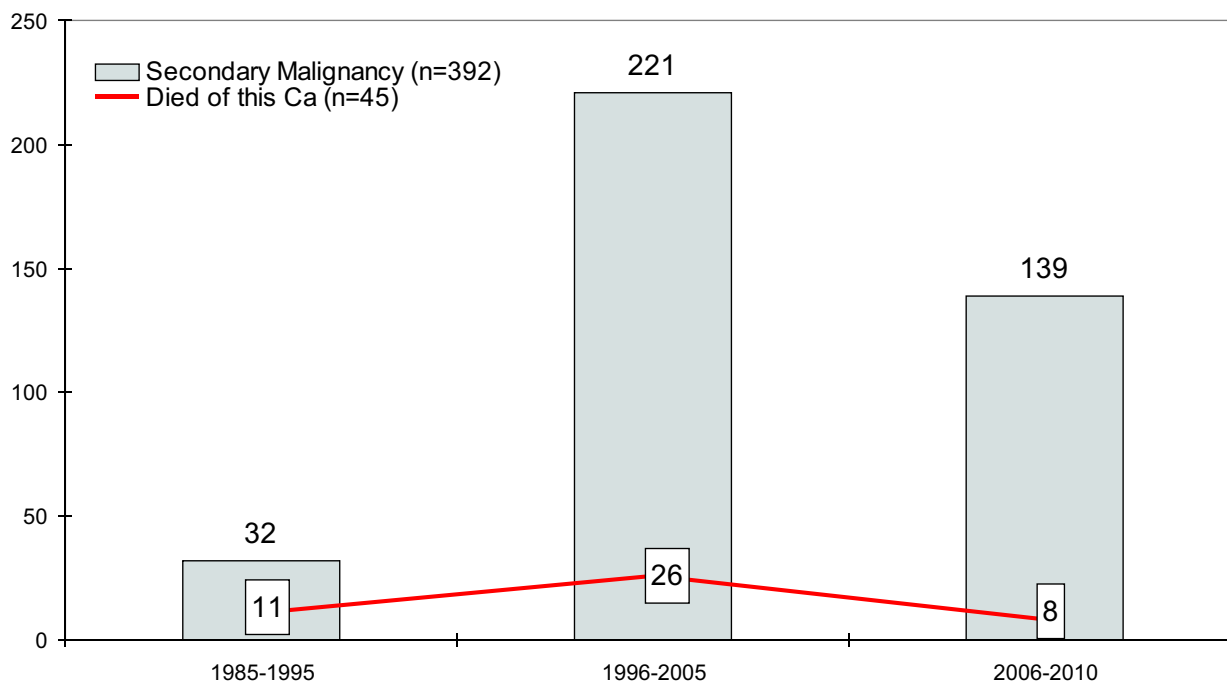
		1yr	5yr	10yr	15yr
CC (n=29)	n	24	9	3	1
	%	81	36	32	4
HCC (n=328)	n	285	162	50	4
	%	86	75	66	43
Hepatoblastoma (n=2)	n	3	1	1	
	%	60	60	60	50
Fibrolamellar (n=3)	n	3	1	1	1
	%	100	60	60	60
Other (n=6)	n	6	3		
	%	100	67		



# Liver Cancer as a Secondary Diagnosis

## Incidence and Mortality

n=390 patients, 392 cancers (11% of patients transplanted)



## Liver Cancer

### (Primary or Secondary Diagnosis)

N = 3510

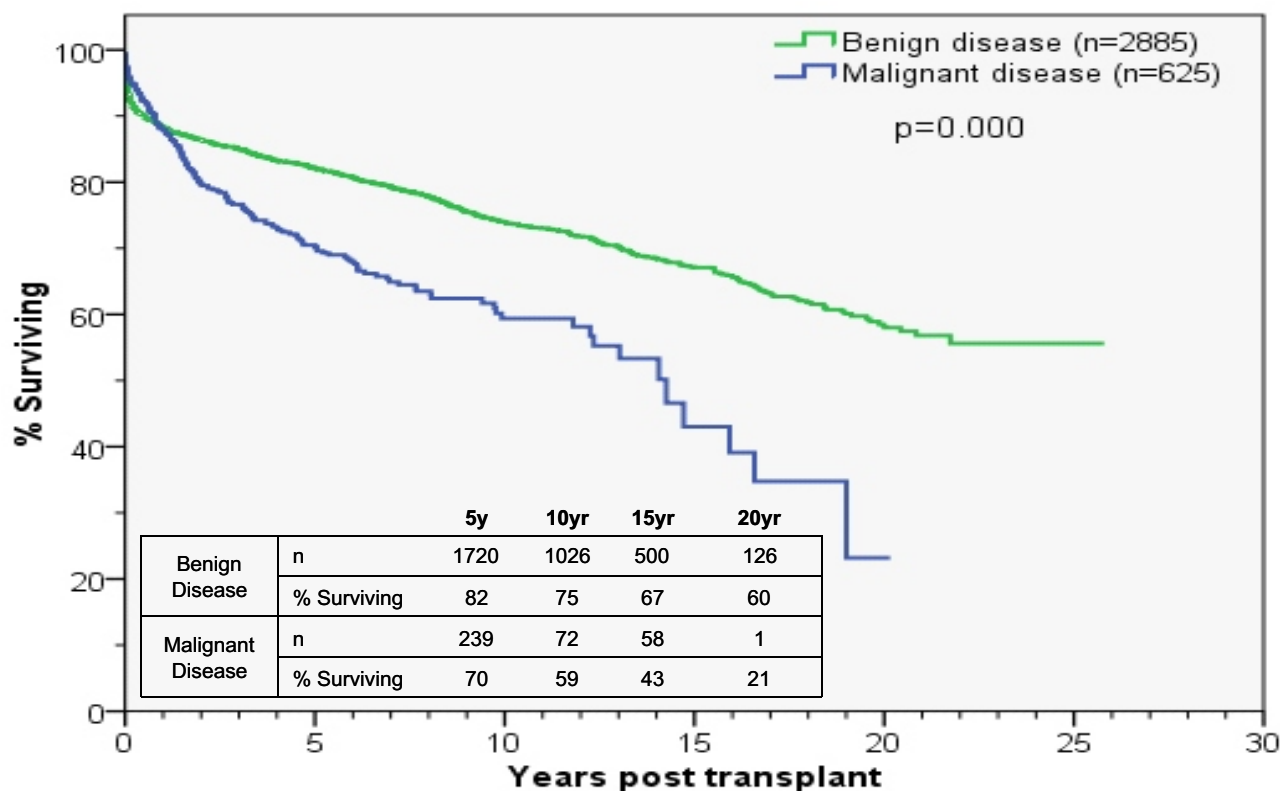
TYPE OF CA	NO	DIED	DIED OF THIS CA
HEPATOCELLULAR CA*	547	145	55 (10%)
CHOLANGIOCARCINOMA*	34	22	14 (41%)
HEPATOBLASTOMA*	19	5	3 (16%)
LAMELLA VARIANT	10	6	3 (30%)
ADENOCARCINOMA	5	4	1 (25%)
CARCINOID	4	4	4 (100%)
EPITHELOID HAEMANGIOENDOTHELIOMA	3	0	0
ANGIOSARCOMA	2	2	2 (100%)
PANCREATIC ISLET CELL	1	1	1 (100%)
GASTRINOMA	1	1	2 (100%)
<b>TOTALS</b>	<b>626* Ca in 624 pts (18% of pts)</b>	<b>190 (30% of pts with Ca at Tx)</b>	<b>85 (14% of pts with Ca at Tx)</b>

\* 2 patients had 2 secondary cancers; 2 patients had a primary and secondary liver malignancy

# Patient Actuarial Survival

## Benign Disease vs Pre Transplant Liver Malignancy

N=3510



## De Novo Non Skin Cancer

N = 3510

m = median

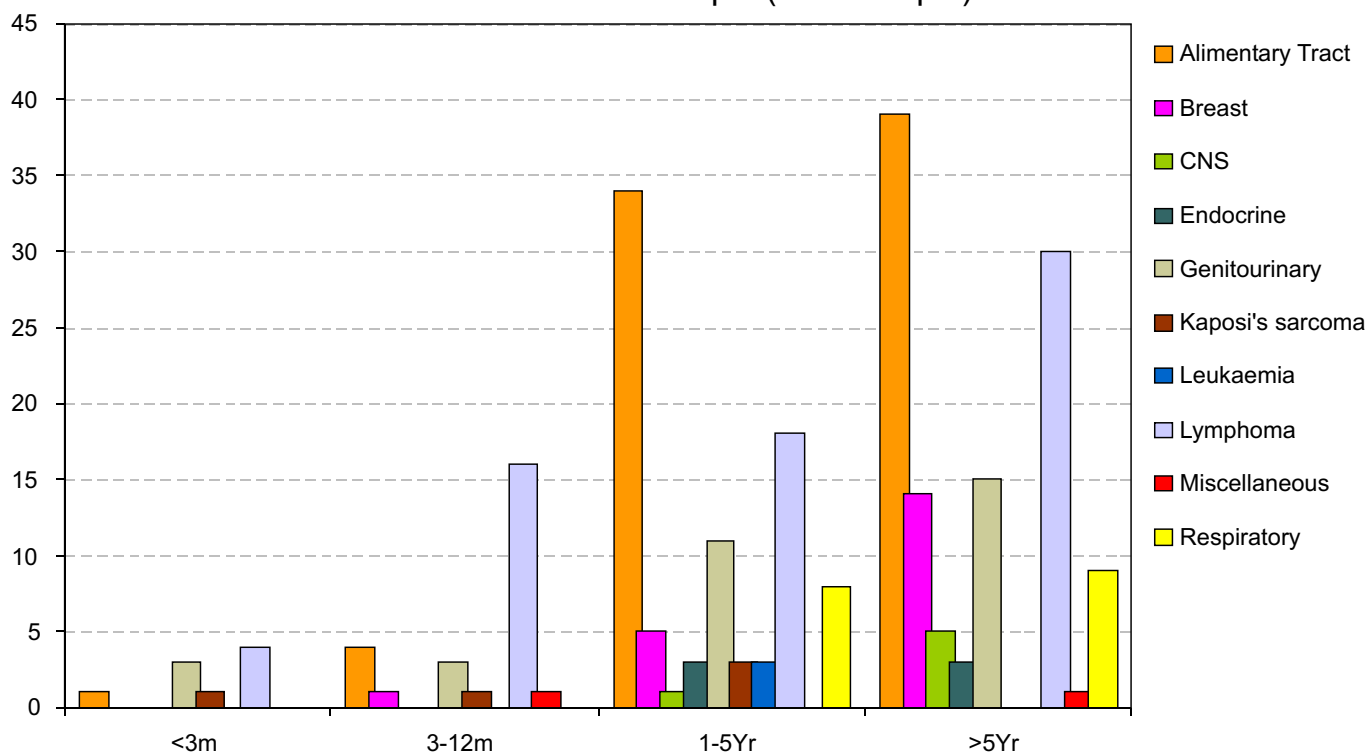
	No	Male	Female	Age of pts (yrs)	Time to diagnosis (mths)	Died of This Cancer
Alimentary*	78	57	21	12.6 – 78 (m 58)	3– 219 (m 62)	38 (49%)
Lymphoma*	68	41	27	1.2 – 70 (m 46)	1 – 207 (m 45)	26 (38%)
Genitourinary*	32	19	13	21– 75 (m 60)	2 – 227 (m 57)	4 (13%)
Breast	20	-	20	30 – 74.2 (m 50)	11 – 241 (m 89)	7 (35%)
Respiratory	17	14	3	29 – 74 (m 58)	6 – 212 (m 60)	13 (76%)
Kaposi's	5	4	1	32 – 65 (m 48)	2 – 48 (m 16)	0
Endocrine	6	3	3	36 – 70 (m 63)	47 – 212 (m 77)	2 (33%)
CNS	6	4	2	17. – 75 (m 65)	14 – 211 (m 121)	5 (83%)
Leukaemia	3	1	2	3 – 49.5 (m 37)	16 – 44 (m 30)	0
Miscellaneous	2	0	2	62 – 67 (m 64)	6 – 60 (m 32)	0
<b>Total</b>	<b>*237 ca in 222 pts</b>	<b>143</b>	<b>94</b>	<b>1– 78 (m 55)</b>	<b>1 – 241 (m 57)</b>	<b>95 (40% of pts with Ca)</b>

Thirty one pts with liver cancer at Tx developed non skin de novo cancer  
\* 12 patients had more than 1 de novo malignancies

# Time to De Novo Non Skin Cancer N = 3510

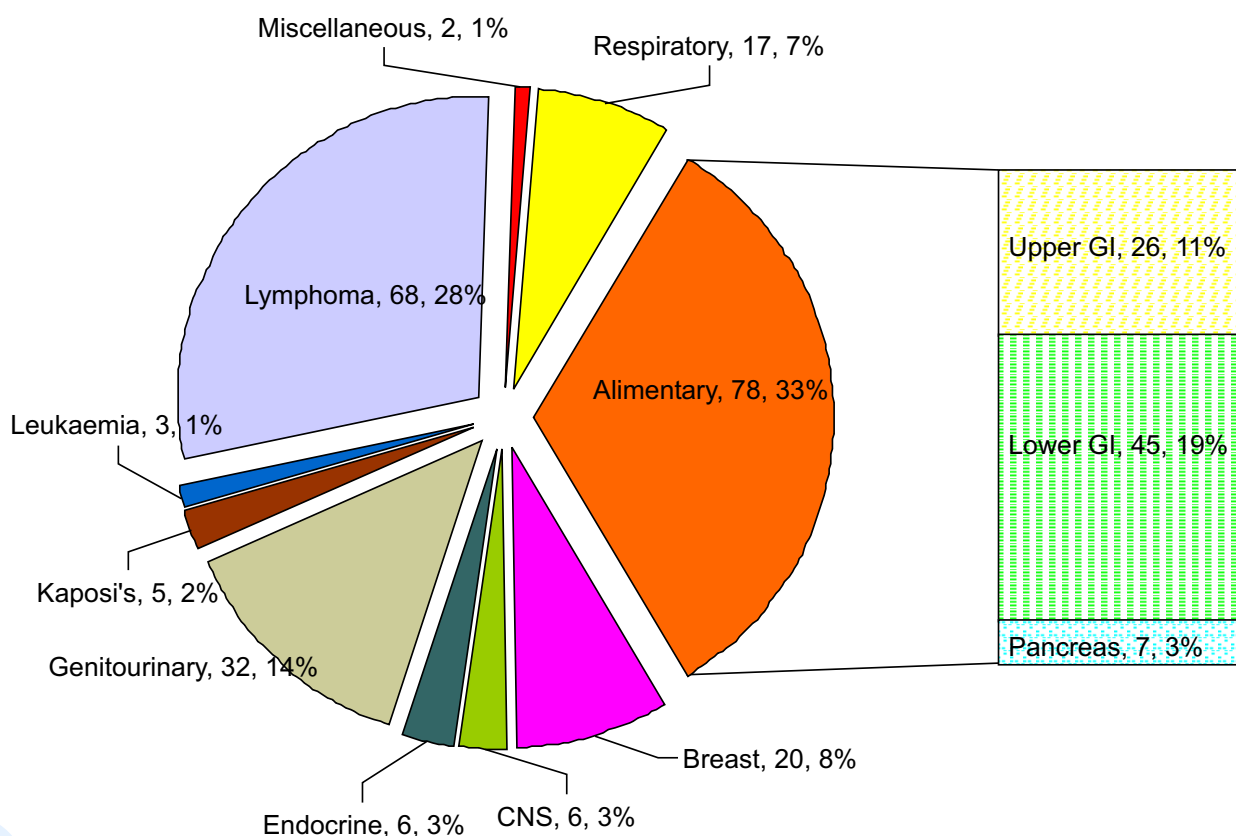


237 cancers in 222 pts (6% of all pts)



## De Novo Non Skin Cancer n = 237/3510 (7%)

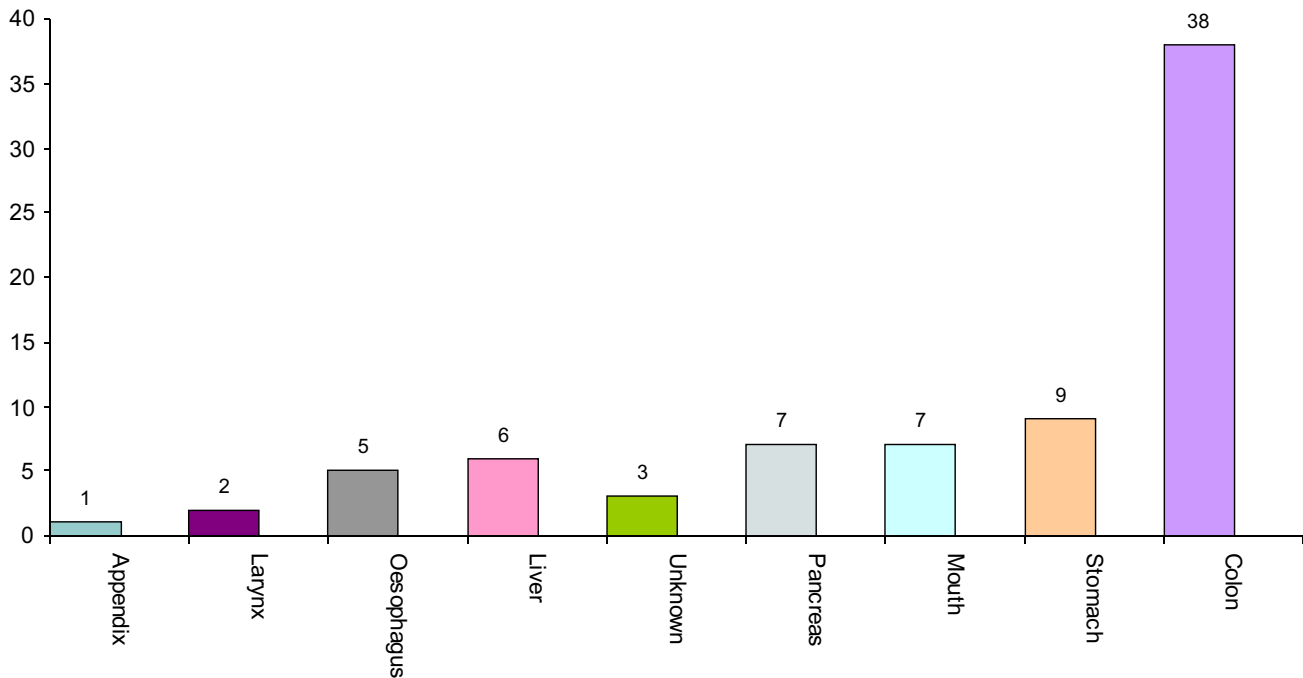
n = 237/3510 (7%)



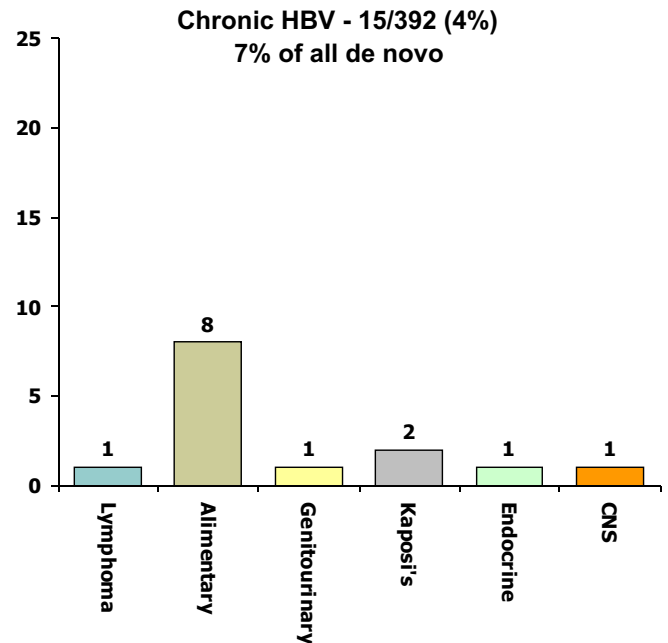
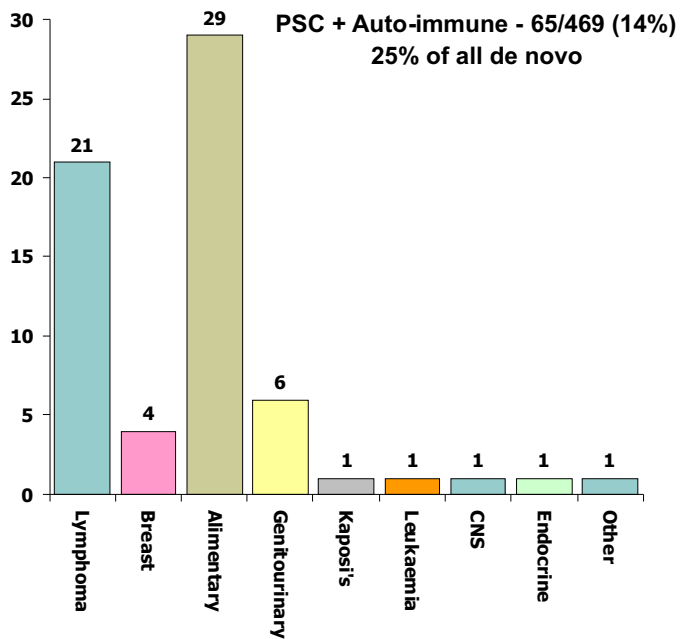
## De Novo Non Skin Cancer Alimentary Tract Incidence n = 78/237 cancers (32%)



n=78/ 237 (32%)



## Pre Transplant Liver Disease and De Novo Non Skin Cancer n = 222/3510 patients (6%)

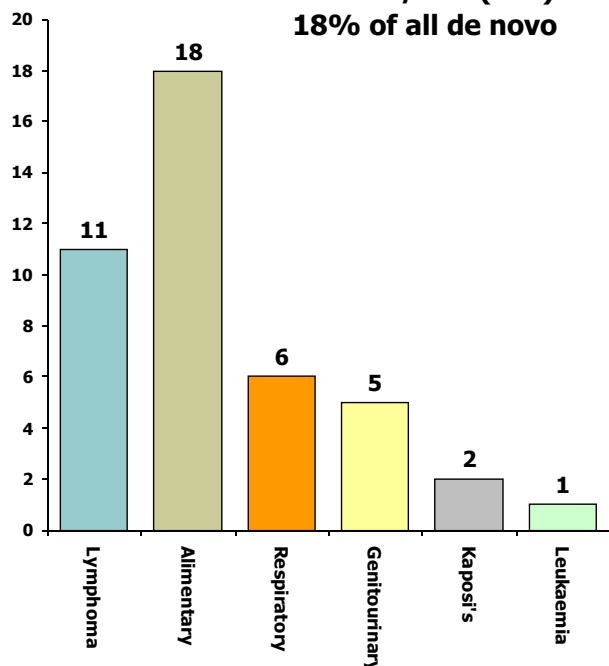


## Pre Transplant Liver Disease and De Novo Non Skin Cancer

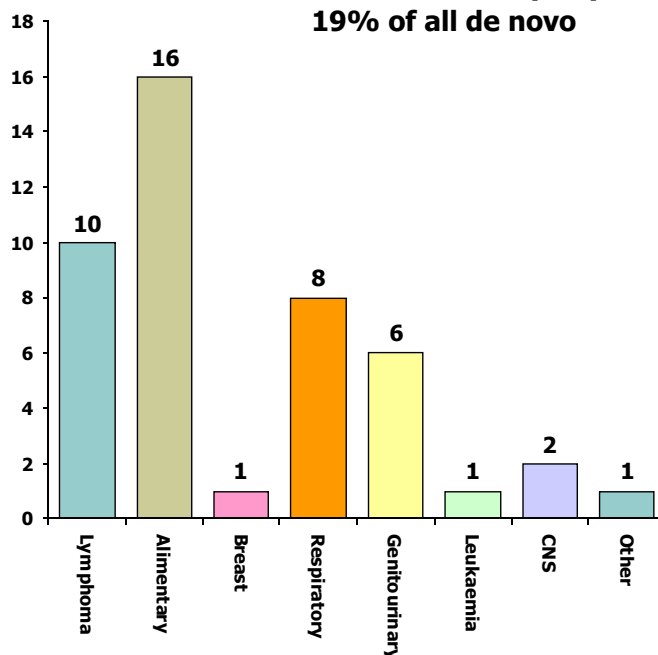
n = 222/3510 patients (6%)



**HCV - 43/761 (6%)**  
**18% of all de novo**

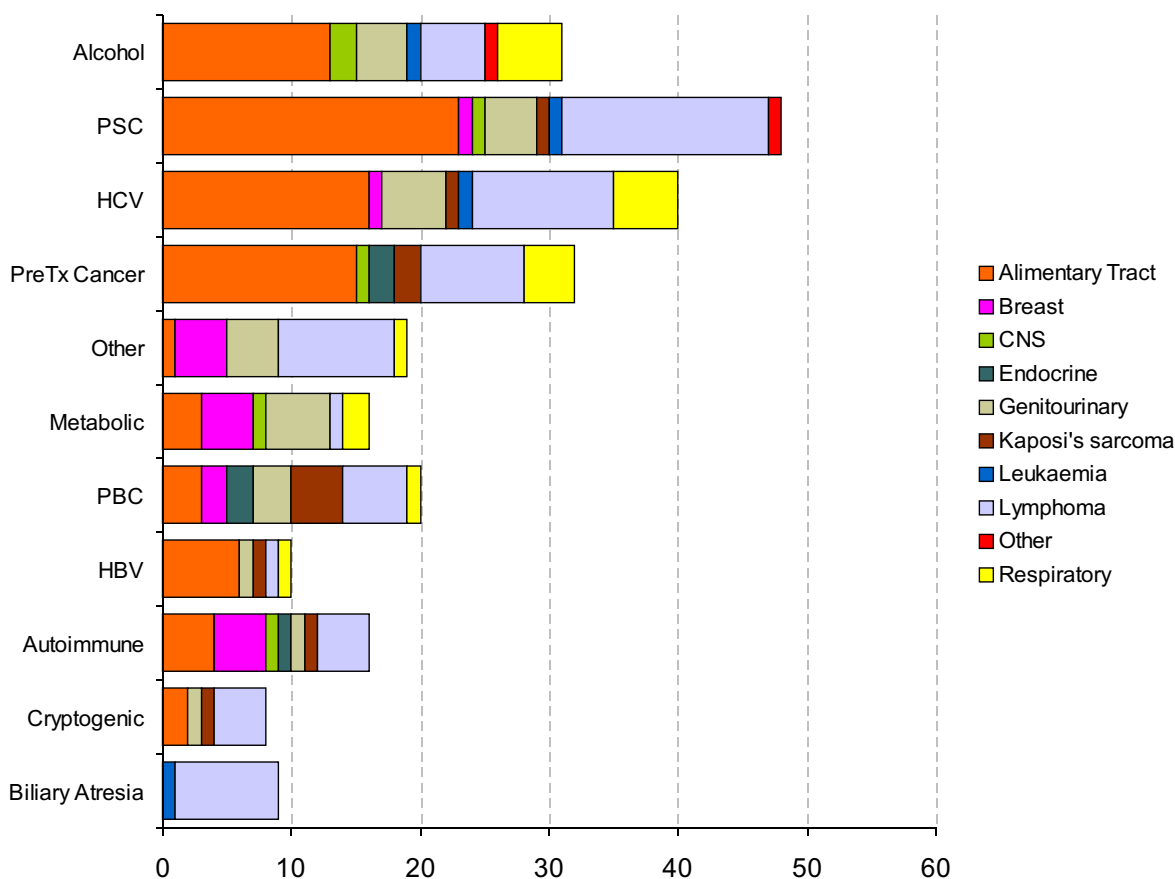


**Alcohol - 45/546 (8%)**  
**19% of all de novo**



## Pre Transplant Liver Disease and De Novo Non Skin Cancer

n = 222/3510 patients (6%)





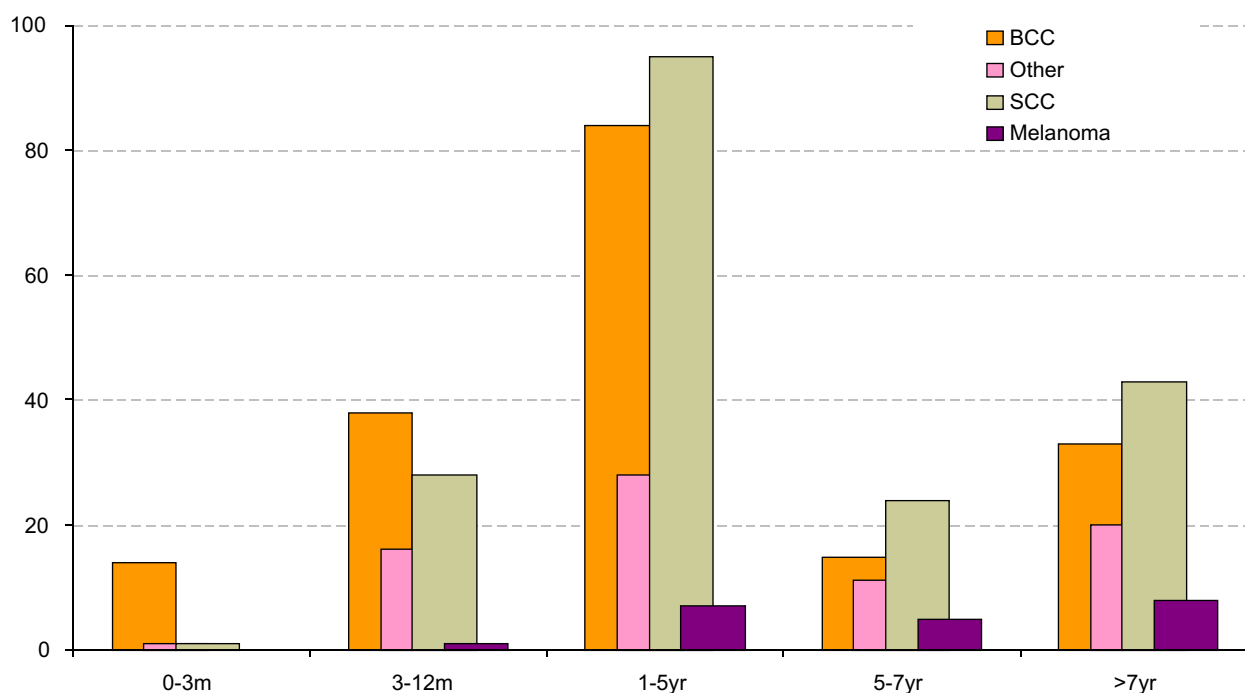
Type of Skin Cancer	Pts
<b>SCC</b>	<b>294</b>
<b>BCC</b>	<b>278</b>
<b>Other</b>	<b>197</b>
<b>Melanoma</b>	<b>21</b>
<b>Total</b>	<b>455 (13% of all pts)**</b>

**\*\* 221 pts had multiple skin cancer types**

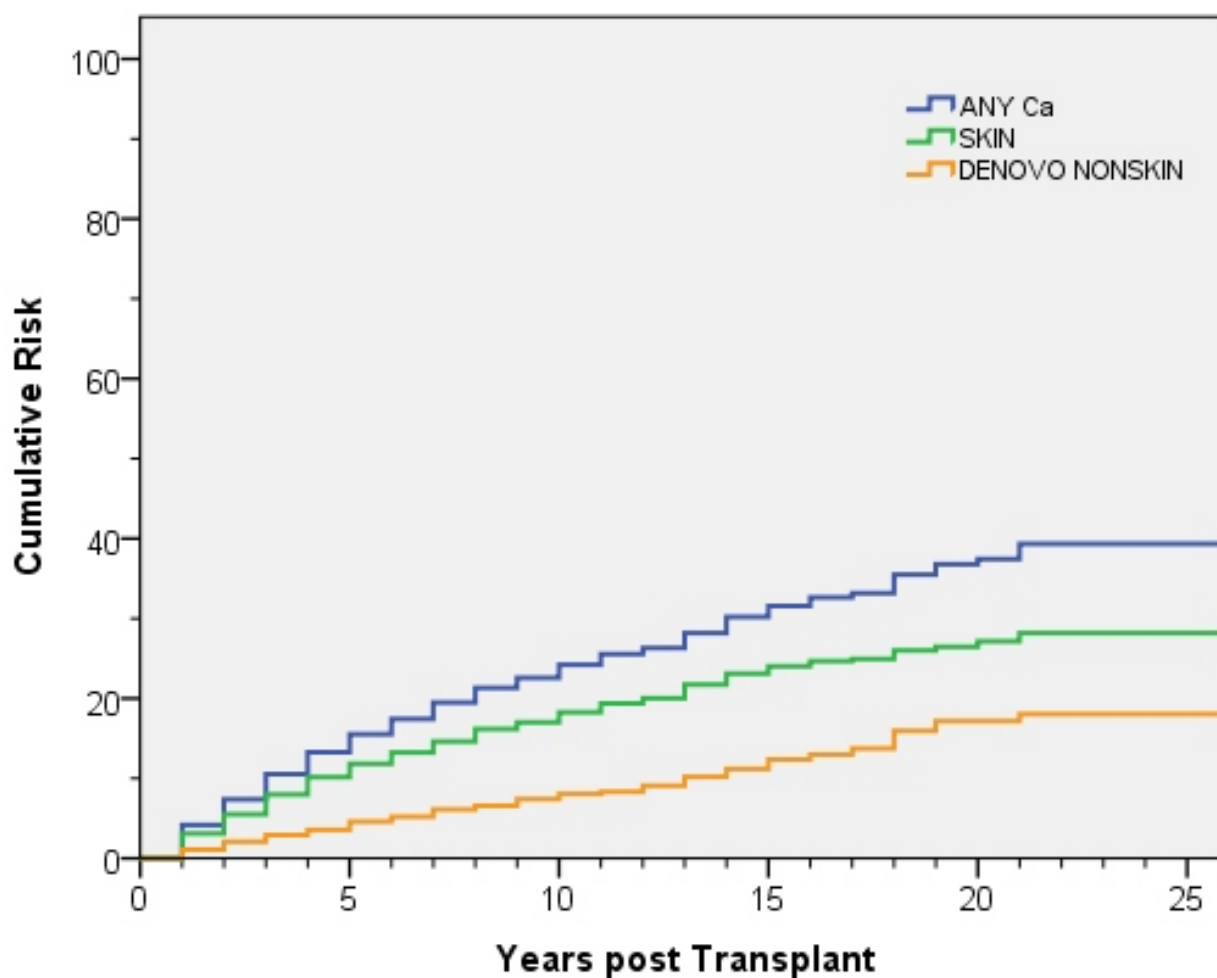
### Time to 1st Skin Cancer Development

n = 3510  
455 (13% of all patients)

455 (13% of all pts)



# Cumulative Risk of Diagnosis of Cancer Following Liver Transplant 1985-2010





# Appendix I

## Liver Transplant Units of Australia and New Zealand

Australian National Liver Transplant Unit  
Royal Prince Alfred Hospital  
Missenden Road  
CAMPERDOWN NSW 2050

*And*

The Children's Hospital at Westmead  
Hawkesbury Road  
WESTMEAD NSW 2145

Email: [anltu@cs.nsw.gov.au](mailto:anltu@cs.nsw.gov.au)

<http://www.sswahs.nsw.gov.au/Gastro/LiverTransplant/default.htm>

Victorian Liver Transplantation Unit  
The Austin Hospital  
Studley Road  
HEIDELBERG VIC 3084

*and*

The Royal Children's Hospital  
Flemington Road  
PARKVILLE VIC 3052

<http://www.austin.org.au/Content.aspx?topicID=397>

Queensland Liver Transplant Service  
Princess Alexandra Hospital  
Ipswich Road  
WOOLLOONGABBA QLD 4102

*and*

The Royal Children's Hospital  
Bowen Bridge Road  
HERSTON QLD 4029

South Australian Liver Transplant Unit  
Flinders Medical Centre  
Flinders Drive  
BEDFORD PARK SA 5042

[http://www.flinders.sa.gov.au/flinders\\_centre\\_for\\_digestive\\_health/](http://www.flinders.sa.gov.au/flinders_centre_for_digestive_health/)

WA Liver Transplantation Service  
Sir Charles Gardiner Hospital  
Verdun Street  
NEDLANDS WA 6009

New Zealand Liver Transplant Unit  
Auckland City Hospital  
Park Road  
Auckland  
New Zealand

[Http://www.nzliver.org/](http://www.nzliver.org/)





# Appendix II

## ANZLTR PRIMARY Diagnosis Metabolic disorders by Age Group

Primary Diagnosis	Age group		Total
	Child	Adult	
-1 Antitrypsin deficiency	33	43	76
Crigler-Najjar	6	1	7
Familial amyloid polyneuropathy	0	30	30
Glycogen storage disease	0	2	2
Haemochromatosis	3	25	28
Homozygous Hypercholesterolemia	4	2	6
Idiopathic copper toxicosis	1	0	1
Indian childhood cirrhosis	1	0	1
Other*	8	4	12
Primary hyperoxaluria	7	6	13
Tyrosinemia	4	0	4
Urea cycle disorders**	15	4	19
Wilsonts disease	8	28	36
Total	90	145	235

\* *Bile acid synthesis disorder*  
*Protein C deficiency*  
*Methylmalonic acidemia*  
*Familial immunodeficiency*  
*Mitochondrial disease*  
*Amyloidosis*  
*Maple syrup urine disease*  
*Porphyria*

\*\* *OTC deficiency 11*  
*Citrullinemia 4*  
*Argininosuccinic aciduria 3*  
*Carbamyl phosphate synthetase deficiency*



# Appendix III

## ANZLTR PRIMARY Diagnosis - Other by Age Group

Primary Diagnosis	Age group		Total
	Child	Adult	
Alagille syndrome	23	4	27
Alagille non-syndromic	2	0	2
Benign liver tumour -Adenomatosis	0	2	2
Benign liver tumour-Hemangioma	0	2	2
Caroli's disease / congenital hepatic fibrosis	3	17	20
Choledocal cyst	1	2	3
Cholestatic disease-Other	1	7	8
Chronic Budd Chiari	1	29	30
Congenital biliary fibrosis	0	1	1
Ductopenia	1	3	4
Granulomatous hepatitis / sarcoidosis	0	4	4
Histiocytosis X	4	0	4
Liver Trauma	0	1	1
Neonatal hepatitis	3	0	3
Nodular regenerative hyperplasia	0	6	6
Non alcoholic fatty liver (NAFLD or NASH)	0	58	58
Polycystic Liver disease	0	15	15
Polycystic liver and kidney disease	0	7	7
Progressive familial intrahepatic cholestasis(PFIC)	18	4	22
Secondary biliary cirrhosis	2	12	14
Secondary biliary cirrhosis - Hepatolithiasis	0	4	4
Secondary biliary cirrhosis - Cystic fibrosis	11	13	24
Other -specify #	3	20	23
Total	73	211	284

# Vanishing bile duct syndrome  
 Haemangiotelangiectasia  
 Veno-occlusive disease  
 Chronic Active Hepatitis A  
 Non-cirrhotic portal hypertension  
 Kassabach-Merritt syndrome  
 Arterial-venous malformation  
 Hereditary haemorrhagic telangiectasia / OWRD  
 Oriental cholangio hepatitis



# Appendix IV

## ANZLTR PRIMARY Diagnosis Fulminant Hepatic Failure by Age Group

Primary Diagnosis	Age group		Total
	Children	Adult	
Acute - Budd Chiari	0	2	2
Acute - Wilson's	6	15	21
Acute - -1 -AAT	2	0	2
Acute Autoimmune hepatitis	0	5	5
Acute Unknown / unspecified	40	81	121
Acute -Paracetamol	2	13	15
Acute -Other drugs	3	17	20
Acute Herbs / mushrooms	0	5	5
Acute - Hepatitis A	0	3	3
Acute - Hepatitis B	0	48	48
Acute - NonA-NonB	4	13	17
Acute - Hepatitis E	0	1	1
Acute - Post liver resection	1	1	2
Subacute - Budd Chiari	1	2	3
Subacute - Wilson's	2	4	6
Subacute Autoimmune hepatitis	1	11	12
Subacute - Drug / Herbs	1	6	7
Subacute - Unknown / unspecified	4	30	34
Subacute - Hepatitis A	0	2	2
Subacute - Hepatitis B	0	14	14
Total	67	273	340



# Appendix V

## ANZLTR Causes of Patient death

<u>Graft failure - other</u>	Age group		Total
	Children	Adult	
Vascular thrombosis	6	13	19
<i>Hepatic artery</i>	4	7	11
<i>Portal vein</i>	1	6	7
<i>Hepatic vein</i>	1	-	1
Non thrombotic infarction	2	-	2
Primary non function	4	16	20
Massive haemorrhagic necrosis	4	0	4
Recurrent disease ( <i>ALD, PSC, CAH:AI</i> )	-	13	13
De novo Hep C	-	3	3
Biliary Complications	3	9	12
Other ( <i>PNC, immune hepatitis, outflow obstruction</i> )	7	6	13
<b>TOTAL</b>	<b>26</b>	<b>60</b>	<b>86</b>

<u>Miscellaneous</u>	Children	Adult	
Multiorgan failure	5	34	39
Renal Failure	1	24	25
Graft vs Host disease	-	6	6
Social ( <i>accident, suicide, non-compliance, Rx withdrawn</i> )	1	11	12
Sudden death ( <i>cause unknown</i> )	1	21	22
Other ( <i>Hyperkalaemia, motor neurone disease, diabetes complications, drug reaction, progression FAP</i> )	1	10	11
<b>TOTAL</b>	<b>9</b>	<b>106</b>	<b>115</b>