


# HEART TRANSPLANTATION

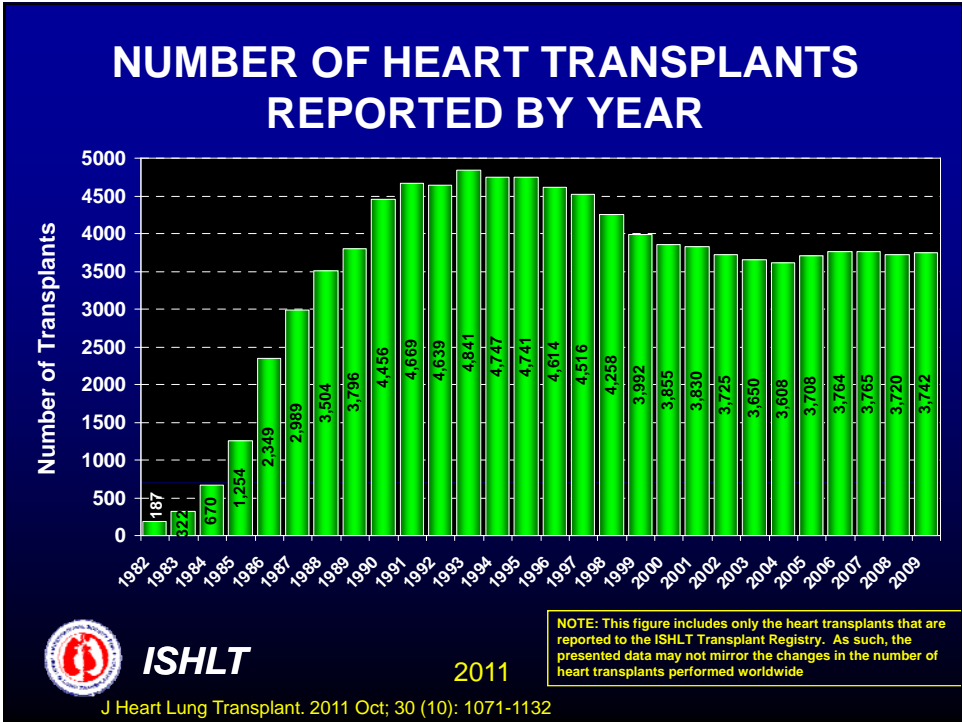
## Overall



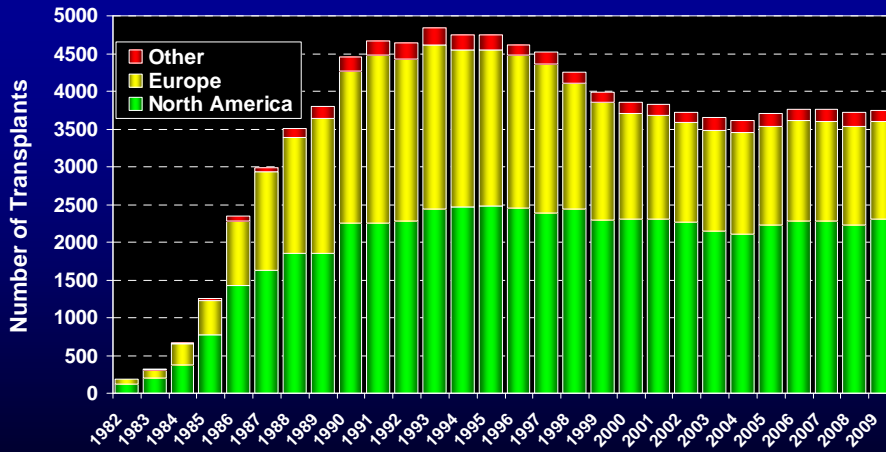
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## NUMBER OF HEART TRANSPLANTS REPORTED BY YEAR



**ISHLT**

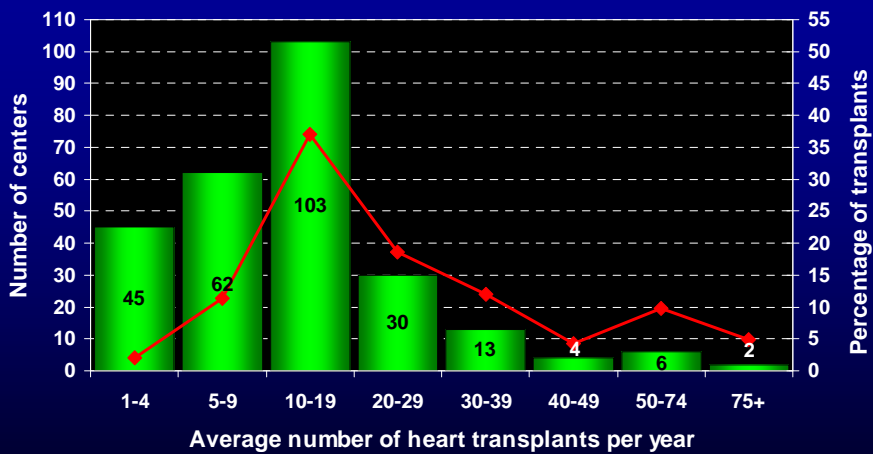
2011

NOTE: This figure includes only the heart transplants that are reported to the ISHLT Transplant Registry. As such, the presented data may not mirror the changes in the number of heart transplants performed worldwide

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## AVERAGE CENTER VOLUME

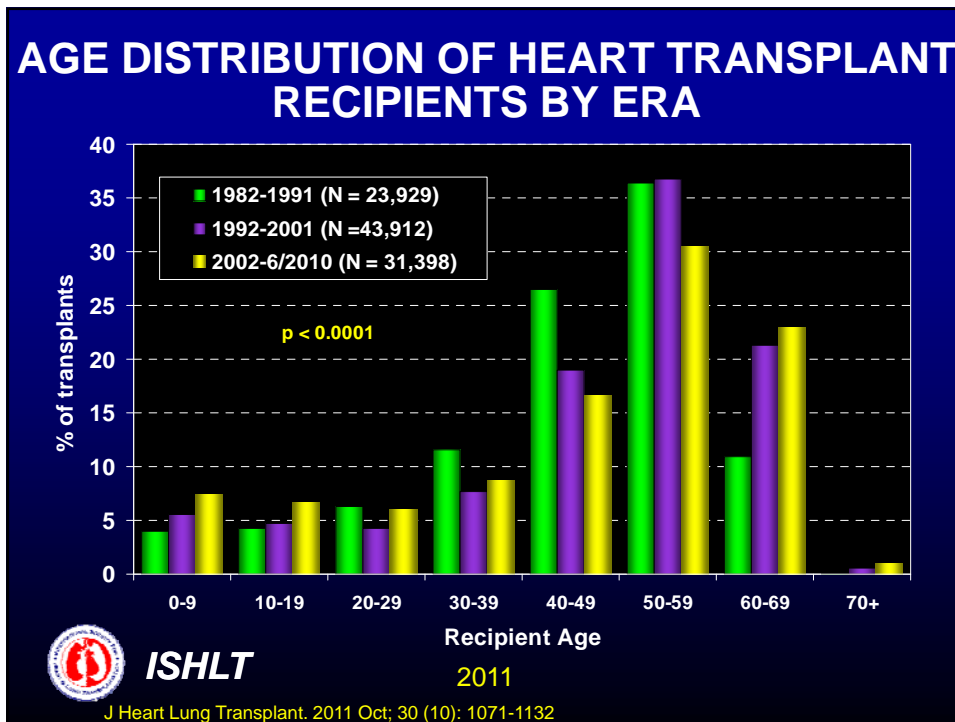
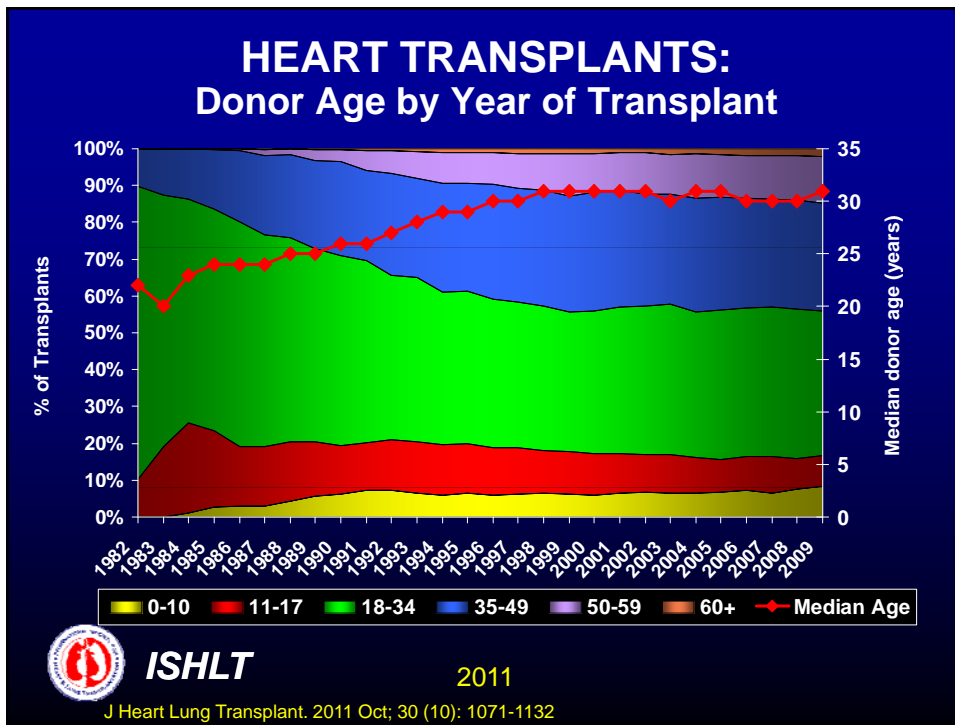
Heart Transplants: January 1, 2003 – June 30, 2010



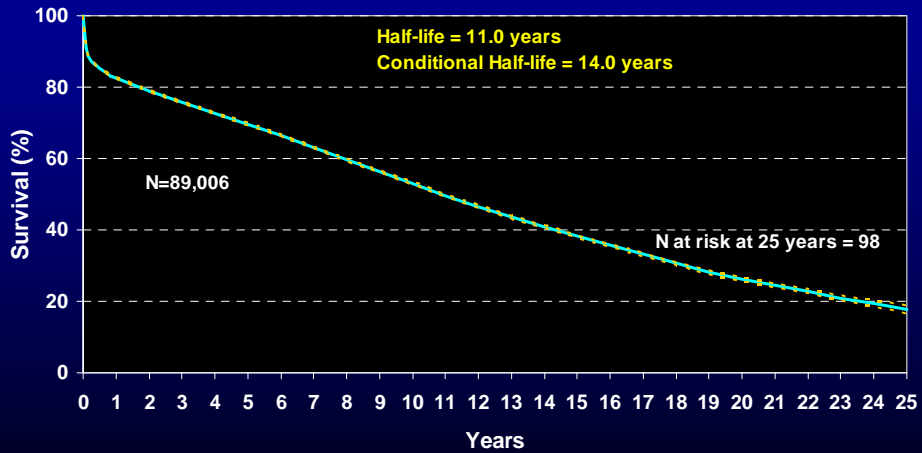
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# HEART TRANSPLANTATION Kaplan-Meier Survival (1/1982-6/2009)



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# HEART TRANSPLANTATION

Adult Recipients



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## ADULT HEART TRANSPLANTATION Donor and Recipient Characteristics

	1992-2001 (N=39,812)	2002-6/2010 (N=27,387)	p-value
Recipient age (years)	54.0 ± 11.0 (28.0 - 65.0)	54.0 ± 12.4 (25.0 - 67.0)	0.5756
Donor age (years)	31.0 ± 12.8 (15.0 - 54.0)	34.0 ± 13.1 (16.0 - 56.0)	<0.0001
Recipient/donor gender (% male)	80.5%/ 68.4%	77.2%/ 69.5%	<0.0001/ 0.0030
Recipient weight (kg)	75.0 ± 16.7 (51.7 - 102.1)	78.0 ± 17.2 (53.0 - 108.8)	<0.0001
Recipient height (cm)	173.0 ± 11.3 (157.0 - 188.0)	175.0 ± 10.7 (157.5 - 188.0)	<0.0001
Recipient BMI	25.0 ± 4.3 (18.9 - 32.8)	25.8 ± 4.7 (19.2 - 34.4)	<0.0001
Donor weight (kg)	75.0 ± 17.6 (52.0 - 103.9)*	78.0 ± 17.1 (55.6 - 110.0)	<0.0001
Donor height (cm)	175.0 ± 18.9 (155.0 - 188.0)*	175.0 ± 10.3 (159.0 - 190.0)	<0.0001
Donor BMI	24.2 ± 4.5 (18.8 - 33.0)*	25.2 ± 4.9 (19.7 - 35.4)	<0.0001
Recipient/donor diabetes mellitus	14.5%/ 1.6%*	22.7%/ 2.5%	<0.0001/ <0.0001
Recipient amiodarone use (US only)	22.6%*	29.4%	<0.0001
Recipient/donor cigarette history	- / 37.5%*	46.9%**/ 23.6%	- / <0.0001
Recipient/donor hypertension	34.6%*/ 10.8%*	40.9%/ 12.4%	<0.0001/ <0.0001
Recipient prior cardiac surgery	-	43.0%**	-



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Continuous factors are expressed as median ± standard deviation (5<sup>th</sup>-95<sup>th</sup> percentiles)

\* Based on 4/1994-2001 transplants.

\*\* Based on 7/2004-6/2010 transplants.

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## ADULT HEART TRANSPLANTATION Donor and Recipient Characteristics

	1992-2001 (N=39,812)	2002-6/2010 (N=27,387)	p-value
Recipient Peripheral Vascular Disease	3.9%*	3.0%	<0.0001
Recipient previous malignancy	3.5%*	5.3%	<0.0001
Recipient COPD	3.2%*	3.6%	0.0601
Ischemic time (hours)	2.6 ± 1.5 (0.0 - 4.6)	3.0 ± 1.5 (0.0 - 5.0)	<0.0001
Most recent PRA > 10%			
Overall	7.8%	9.2%**	0.0016
Class I		13.3%***	
Class II		9.0%***	
Creatinine at time of transplant	1.2 ± 9.7 (0.7 - 2.5)	1.2 ± 0.9 (0.7 - 2.3)	0.0001
Pulmonary vascular resistance (Wood units)	2.1 ± 2.2 (0.4 - 6.0)*	2.1 ± 2.0 (0.3 - 5.6)	<0.0001

Continuous factors are expressed as median ± standard deviation (5th-95th percentiles)

\* Based on 4/1994-2001 transplants.

\*\* Based on US 2002-6/2004 transplants and non US 2002 - 6/2010 transplants

\*\*\* Based on US 7/2004-6/2010 transplants. Until mid-2004 PRA was collected in US as a single percentage. After this date, PRA was collected separately for Class I and Class II.



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## ADULT HEART TRANSPLANTATION Donor and Recipient Characteristics

	1992-2001 (N=39,812)	2002-6/2010 (N=27,387)	p-value
HLA Mismatches			0.0003
0-2	4.8%	4.2%	
3-4	41.6%	40.4%	
5-6	53.6%	55.4%	
Diagnosis			<0.0001
Coronary artery disease	45.7%	39.5%	
Cardiomyopathy	46.4%	51.6%	
Valvular	3.7%	3.0%	
Retransplant	1.9%	2.4%	
Congenital	1.9%	2.8%	
Other causes	0.4%	0.7%	



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## ADULT HEART TRANSPLANTATION Donor and Recipient Characteristics

	1992-2001 (N=39,812)	2002-6/2010 (N=27,387)	p-value
Donor cause of death			<0.0001
Head trauma	45.7%	50.2%	
Stroke	28.5%	28.8%	
Other	25.8%	21.1%	
Pre-operative support (multiple items may be reported)			
Hospitalized at time of transplant	58.7%	46.0%	<0.0001
On IV inotropes	55.3%*	44.8%	<0.0001
LVAD	1.7%***	19.0%	<0.0001
IABP	6.7%	6.7%	0.7815
RVAD	-	4.1%****	-
Ventilator	3.5%	3.0%	0.0065
TAH	0.1%***	0.5%	<0.0001
ECMO	0.3%**	0.8%	<0.0001



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\* Based on 4/1994-2001 transplants.

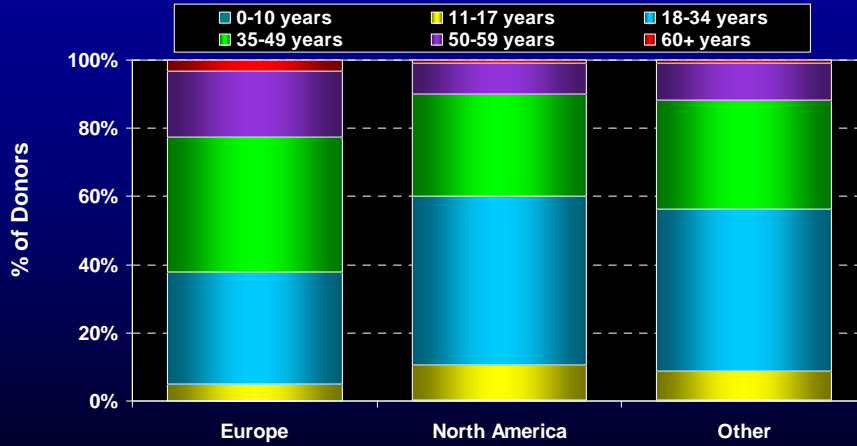
\*\* Based on 5/1995-2001 transplants.

\*\*\* Based on 11/1999-2001 transplants.

\*\*\*\* Based on 2005-6/2010 transplants.

## ADULT HEART TRANSPLANTS DONOR AGE DISTRIBUTION BY LOCATION

Transplants between January 2000 and June 2010



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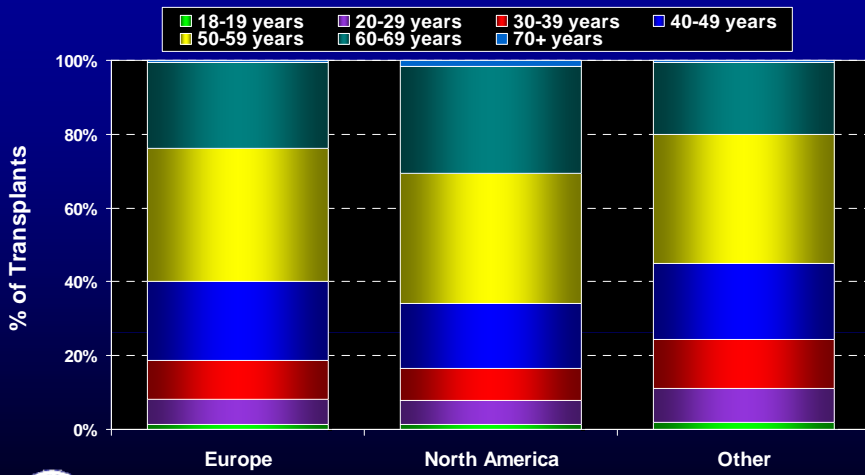
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Mean/median donor age:  
 Europe = 38.3/40.0  
 North America = 31.7/29.0  
 Other = 32.9/31.0

## ADULT HEART TRANSPLANTS RECIPIENT AGE DISTRIBUTION BY LOCATION

Transplants between January 2000 and June 2010



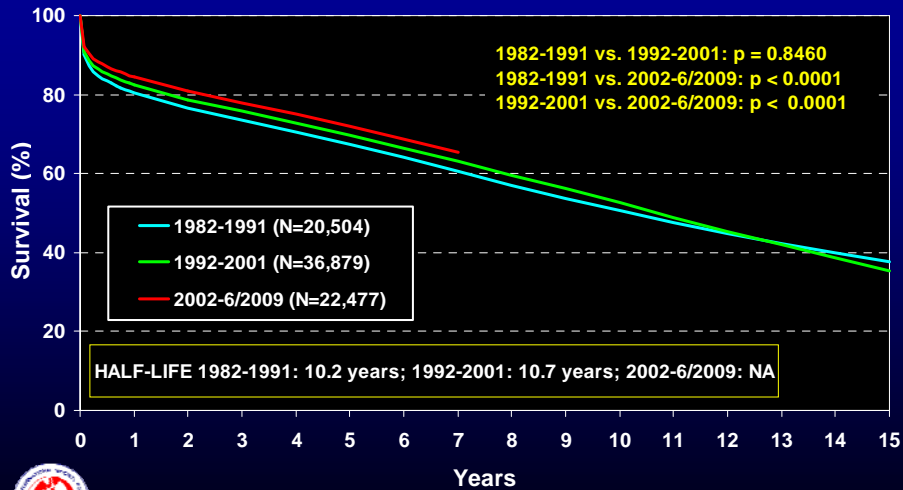
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Mean/median recipient age:  
 Europe = 50.1/53.0  
 North America = 51.8/55.0  
 Other = 48.3/51.0

## ADULT HEART TRANSPLANTATION Kaplan-Meier Survival by Era (Transplants: 1/1982 – 6/2009)

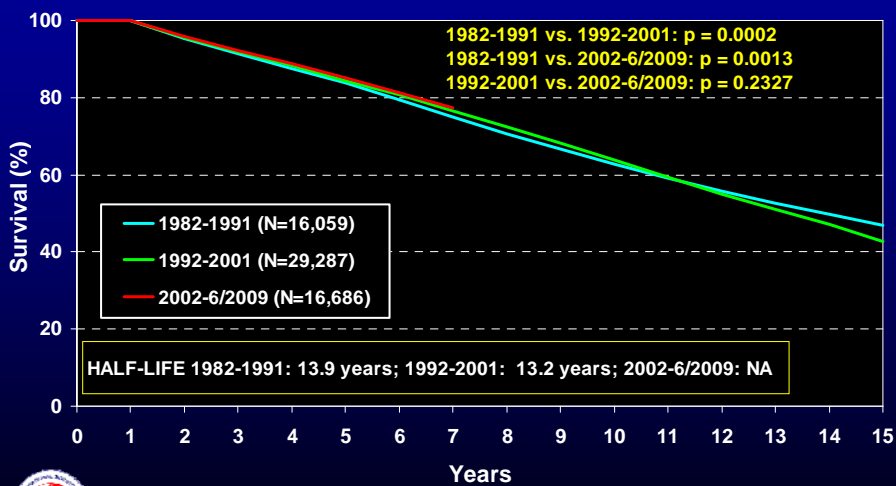


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## ADULT HEART TRANSPLANTATION Conditional Kaplan-Meier Survival by Era (Transplants: 1/1982 – 6/2009)



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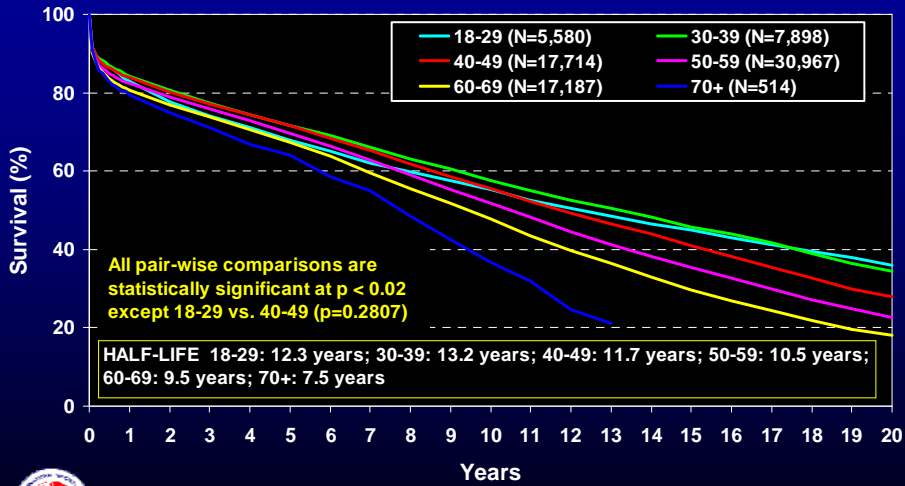
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# ADULT HEART TRANSPLANTATION

## Kaplan-Meier Survival by Age Group

(Transplants: 1/1982-6/2009)



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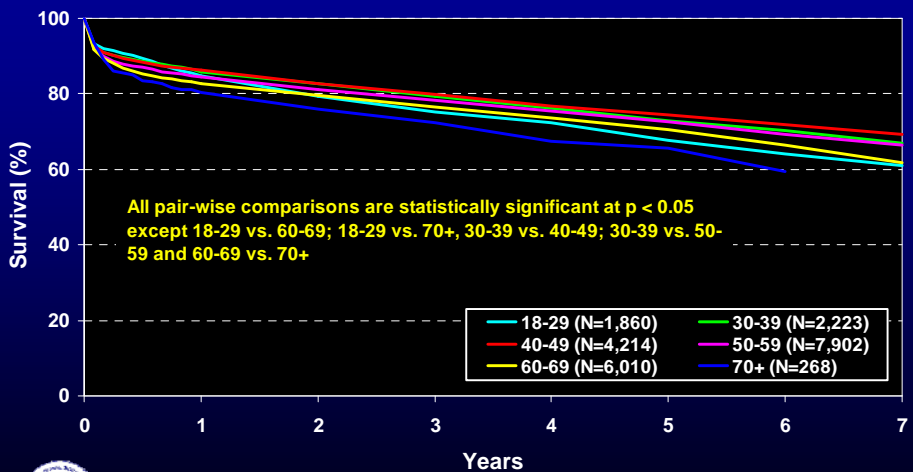
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# ADULT HEART TRANSPLANTATION

## Kaplan-Meier Survival by Age Group

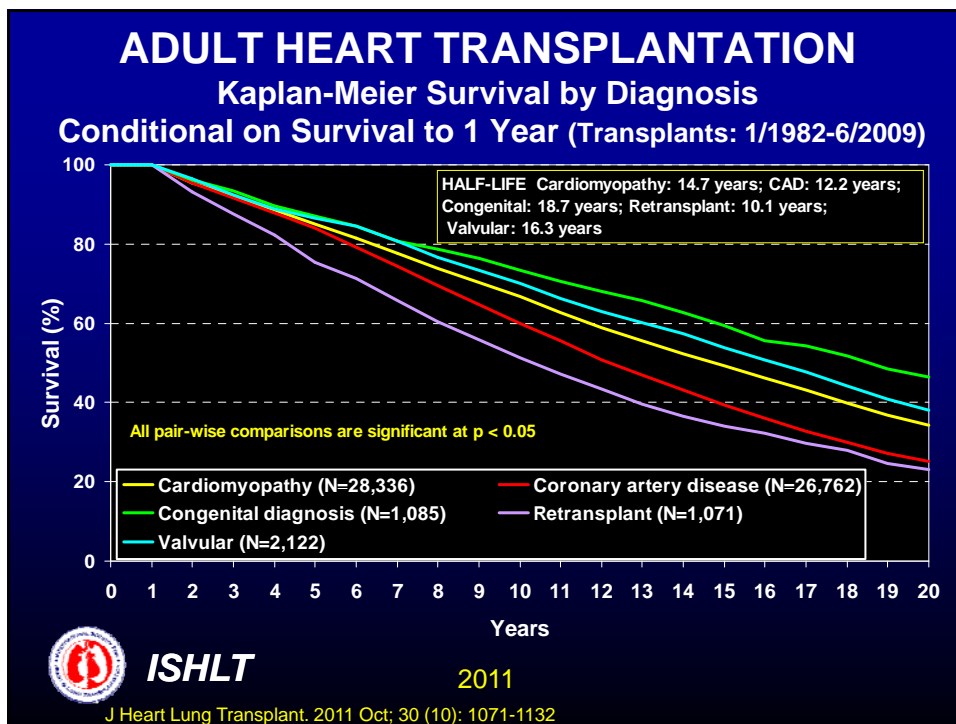
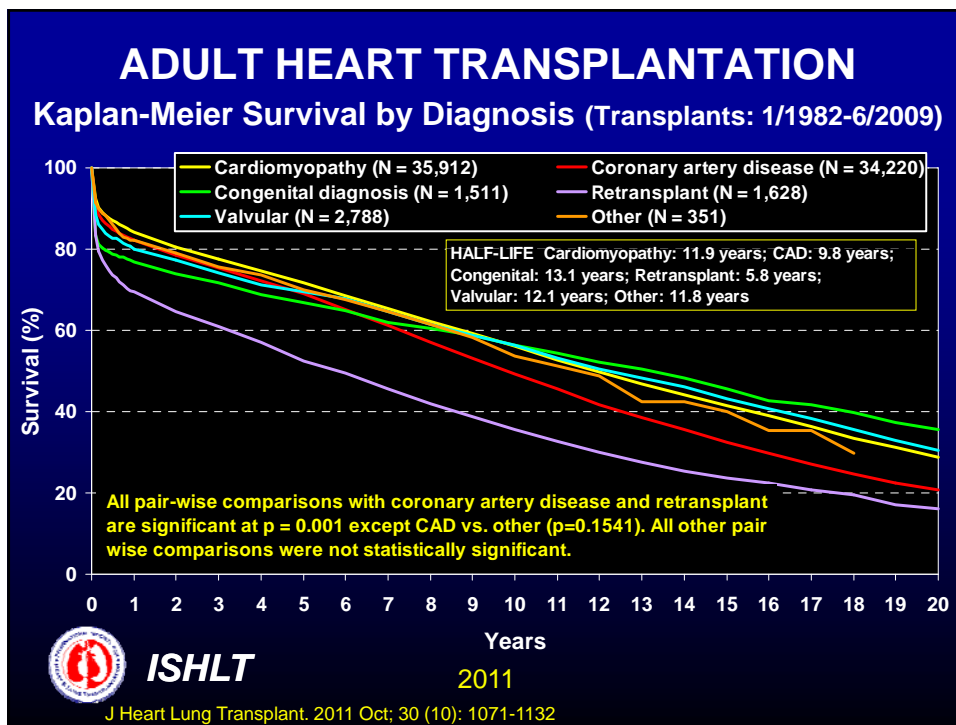
(Transplants: 1/2002-6/2009)



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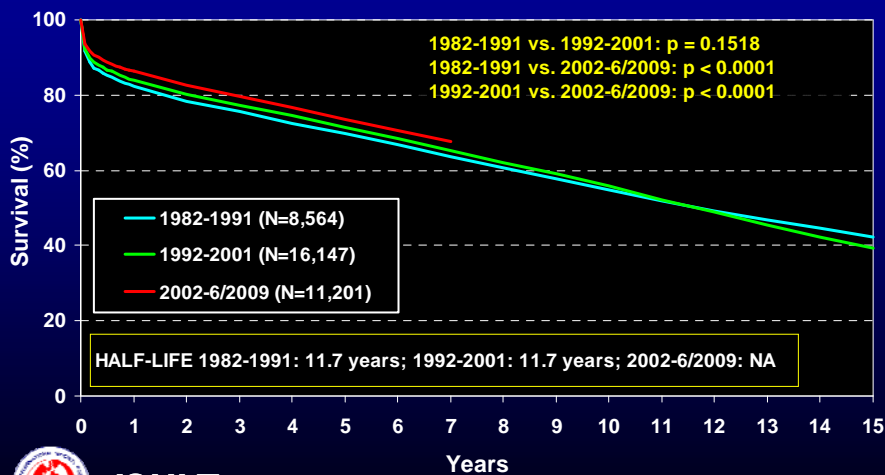
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## ADULT HEART TRANSPLANTATION

Kaplan-Meier Survival by Era (Transplants: 1/1982 – 6/2009)

Diagnosis: **Cardiomyopathy**



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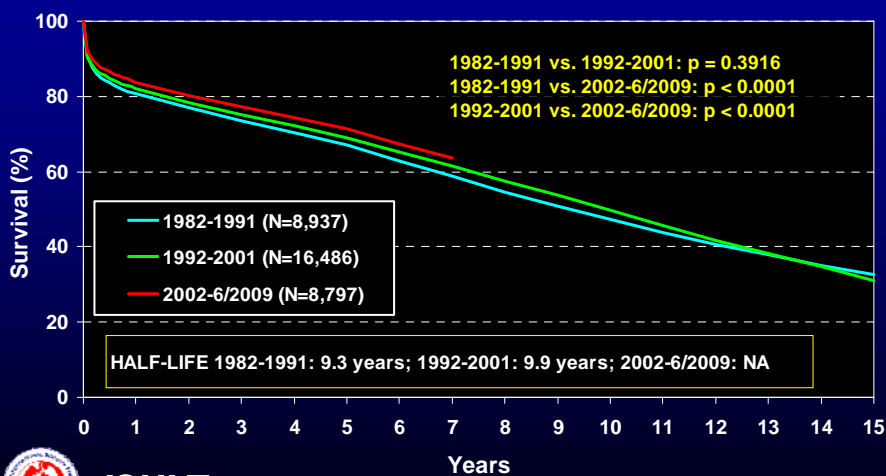
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## ADULT HEART TRANSPLANTATION

Kaplan-Meier Survival by Era (Transplants: 1/1982 – 6/2009)

Diagnosis: **Coronary Artery Disease**



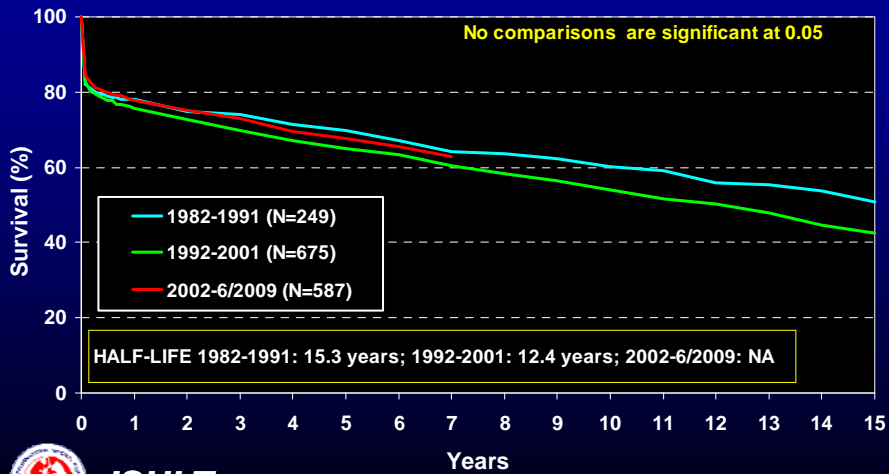
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# ADULT HEART TRANSPLANTATION

Kaplan-Meier Survival by Era (Transplants: 1/1982 – 6/2009)  
**Diagnosis: Congenital**



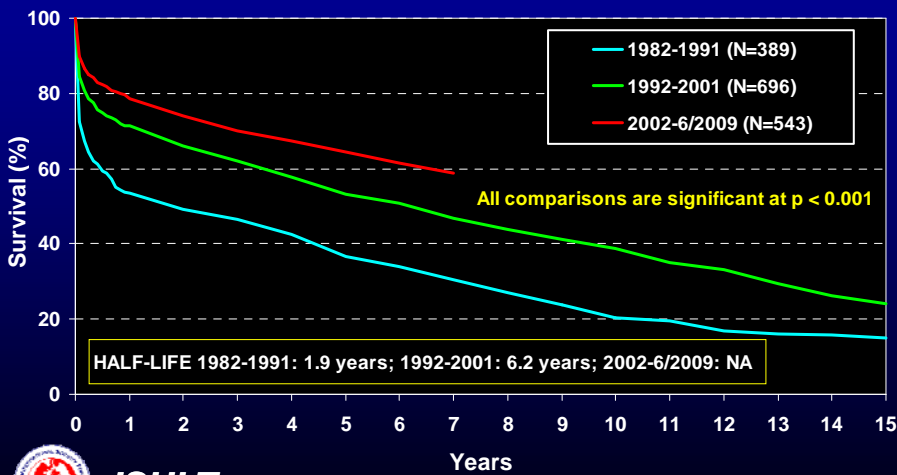
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# ADULT HEART TRANSPLANTATION

Kaplan-Meier Survival by Era (Transplants: 1/1982 – 6/2009)  
**Diagnosis: Retransplant**



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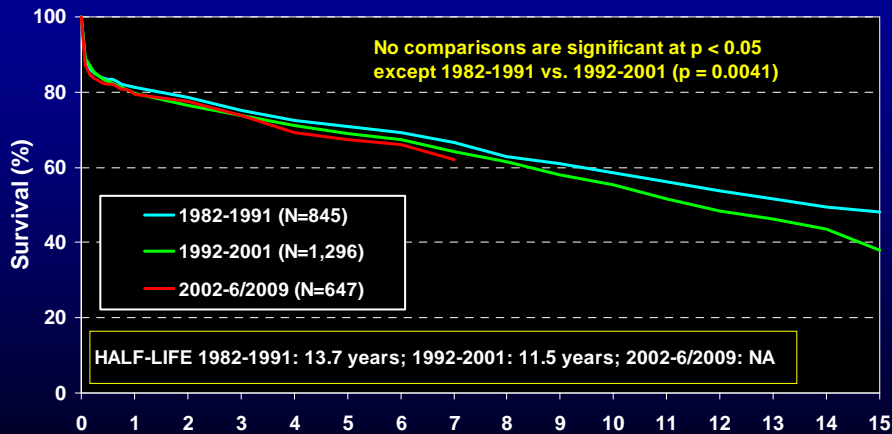
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# ADULT HEART TRANSPLANTATION

## Kaplan-Meier Survival by Era (Transplants: 1/1982 – 6/2009)

### Diagnosis: Valvular



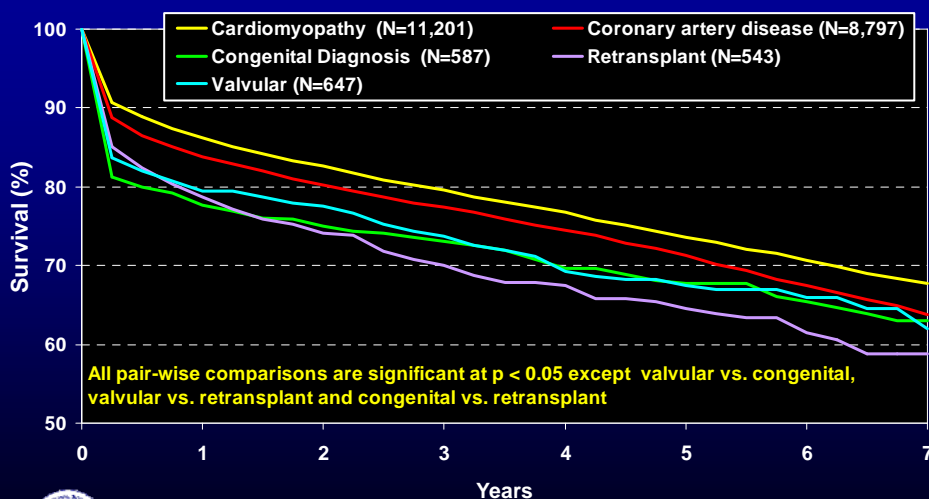
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# ADULT HEART TRANSPLANTATION

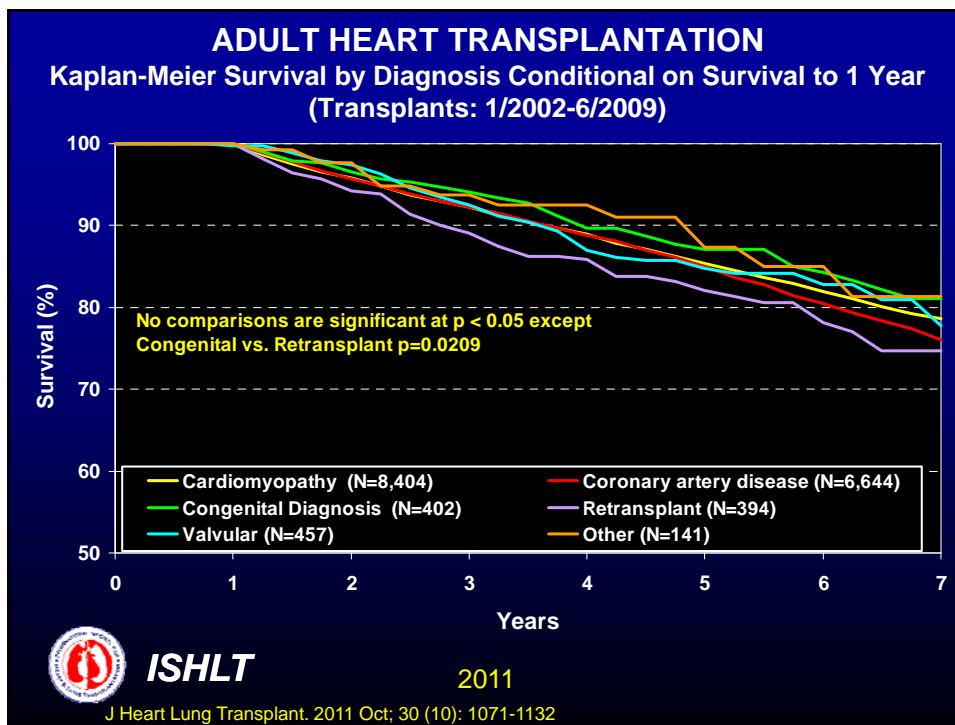
## Kaplan-Meier Survival by Diagnosis (Transplants: 1/2002-6/2009)



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### ADULT HEART TRANSPLANTS (1/2004-6/2009)

#### Risk Factors for 1 Year Mortality

VARIABLE	N	Relative Risk	P-value	95% Confidence Interval
Temporary circulatory support*	180	3.32	<.0001	2.46 -4.48
Diagnosis: Congenital vs. cardiomyopathy	271	2.23	<.0001	1.67 -2.97
Temporary continuous flow device	31	2.10	0.0204	1.12 -3.92
Total artificial heart	58	1.82	0.0365	1.04 -3.20
Recipient history of dialysis	256	1.72	<.0001	1.35 -2.19
Recipient on ventilator at time of transplant	285	1.59	0.0006	1.22 -2.07
Previous transplant	298	1.51	0.0046	1.14 -2.01
Chronic continuous flow device	731	1.48	0.0008	1.18 -1.87
Chronic pulsatile flow device	1401	1.34	0.0022	1.11 -1.62
Prior transfusion	2056	1.26	0.0032	1.08 -1.46
Recipient with infection requiring IV drug therapy within 2 weeks prior to transplant	1021	1.23	0.019	1.03 -1.46
Donor cause of death: anoxia vs. head trauma	1146	1.22	0.0275	1.02 -1.45
Diagnosis: coronary artery disease vs. cardiomyopathy	4257	1.19	0.0126	1.04 -1.36
Ventricular remodeling	1348	0.80	0.0177	0.66 -0.96
Balloon pump	578	0.71	0.0062	0.55 -0.91

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\* Temporary circulatory support includes ECMO and temporary pulsatile flow devices.  
**(N=10,271)**

## ADULT HEART TRANSPLANTS (1/2004-6/2009) Borderline Significant Risk Factors for 1 Year Mortality

VARIABLE	N	Relative Risk	P-value	95% Confidence Interval
Donor cause of death: CNS tumor vs. head trauma	105	1.56	0.0651	0.97 -2.52
Transplant year: 1996 vs. 2008/2009	1926	1.18	0.0609	0.99 -1.40



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(N=10,271)

## ADULT HEART TRANSPLANTS (1/2004-6/2009) Risk Factors for 1 Year Mortality

### Continuous Factors (see figures)

Recipient age	Ischemia time
Recipient height	Bilirubin
Recipient weight	Serum creatinine
Donor age	PRA
Donor weight	Pulmonary capillary wedge pressure
Transplant center volume	Recipient PVR



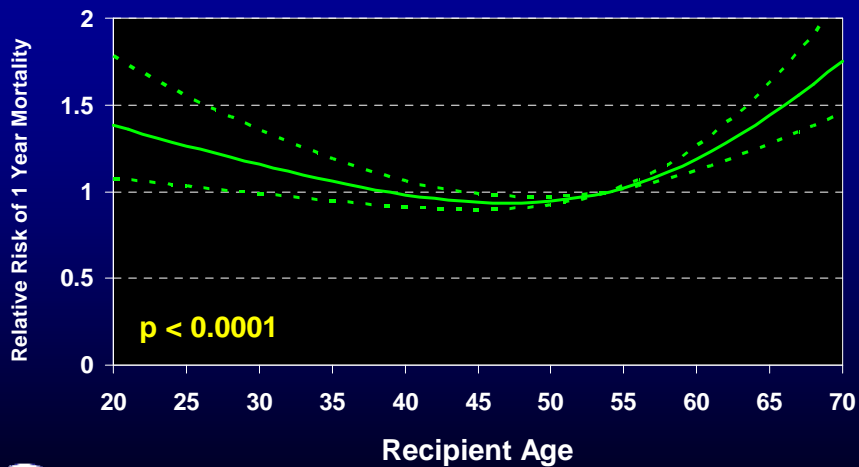
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**ADULT HEART TRANSPLANTS** (1/2004-6/2009)  
 Relative Risk of 1 Year Mortality with 95% Confidence Limits

**Recipient Age**



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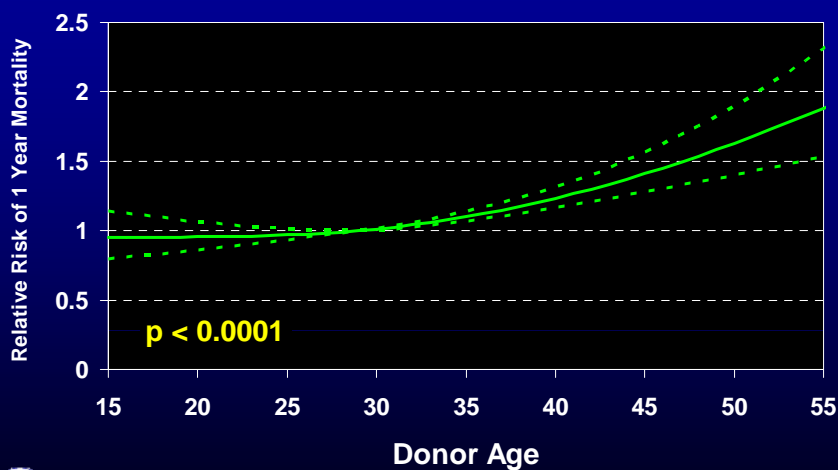
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**ADULT HEART TRANSPLANTS** (1/2004-6/2009)  
 Relative Risk of 1 Year Mortality with 95% Confidence Limits

**Donor Age**



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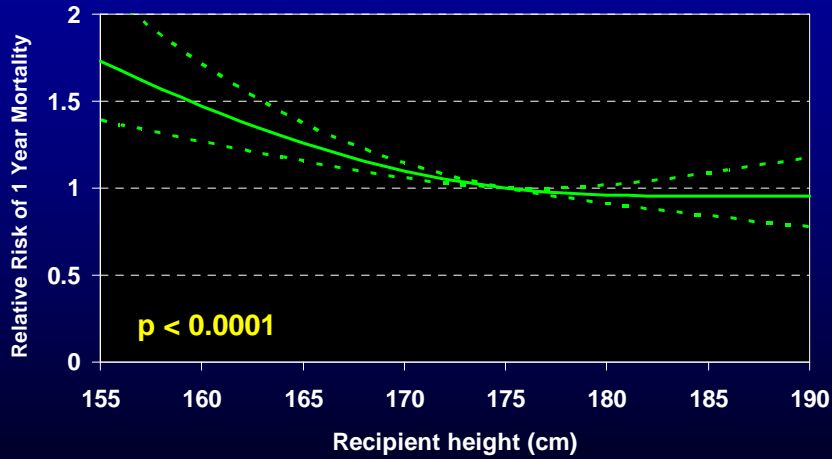
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**(N=10,271)**



**ADULT HEART TRANSPLANTS (1/2004-6/2009)**  
**Relative Risk of 1 Year Mortality with 95% Confidence Limits**  
**Recipient Height**



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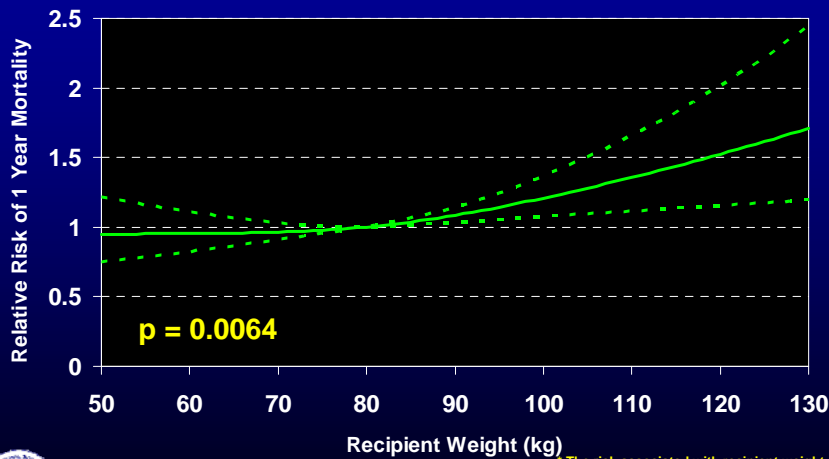
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\* The risk associated with recipient height should be considered in conjunction with the risk associated with recipient weight and donor weight.

**(N=10,271)**

**ADULT HEART TRANSPLANTS (1/2004-6/2009)**  
**Relative Risk of 1 Year Mortality with 95% Confidence Limits**  
**Recipient Weight**



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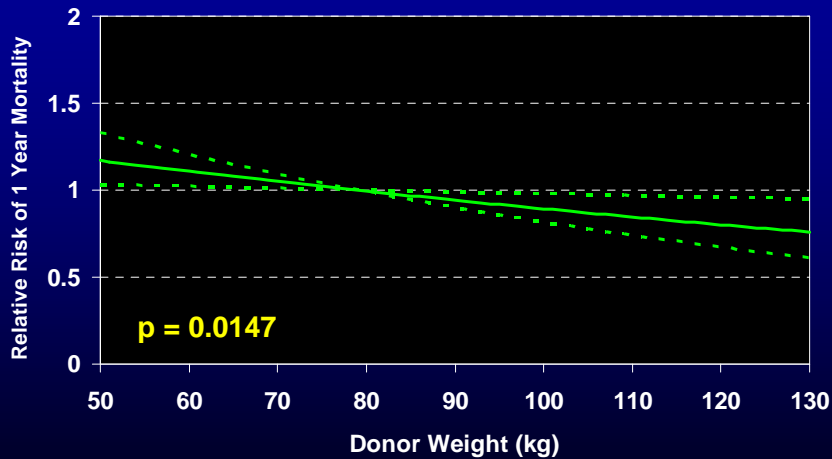
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\* The risk associated with recipient weight should be considered in conjunction with the risk associated with recipient height and donor weight.

**(N=10,271)**

**ADULT HEART TRANSPLANTS** (1/2004-6/2009)  
 Relative Risk of 1 Year Mortality with 95% Confidence Limits  
**Donor Weight**



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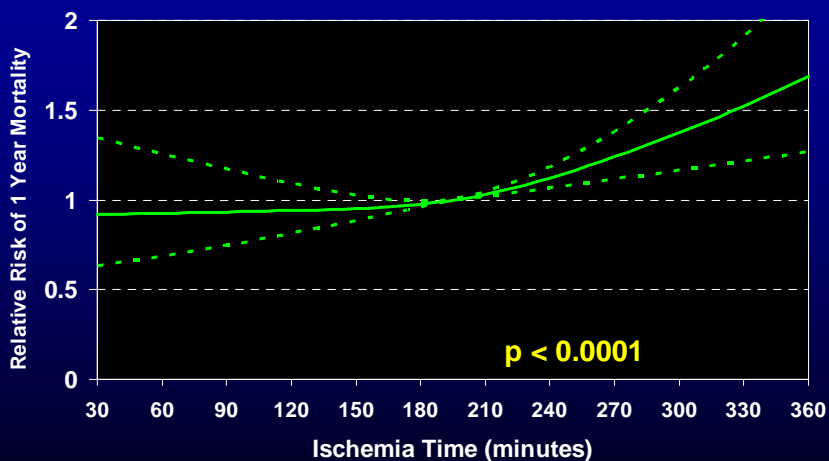
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\* The risk associated with donor weight should be considered in conjunction with the risk associated with recipient height and recipient weight.

**(N=10,271)**

**ADULT HEART TRANSPLANTS** (1/2004-6/2009)  
 Relative Risk of 1 Year Mortality with 95% Confidence Limits  
**Ischemia Time**



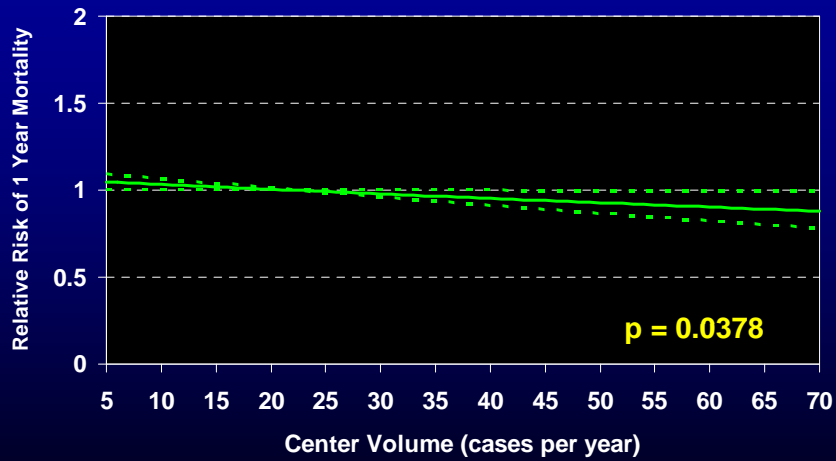
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**ADULT HEART TRANSPLANTS** (1/2004-6/2009)  
 Relative Risk of 1 Year Mortality with 95% Confidence Limits  
**Center Volume**



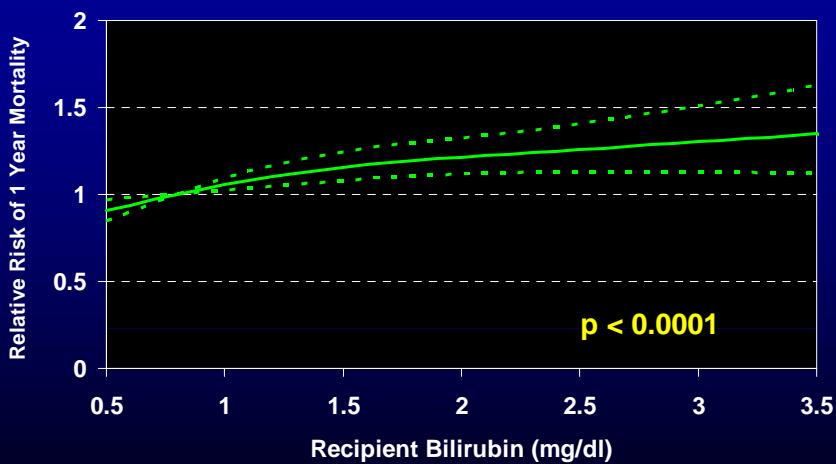
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**ADULT HEART TRANSPLANTS** (1/2004-6/2009)  
 Relative Risk of 1 Year Mortality with 95% Confidence Limits  
**Pre-Transplant Bilirubin**



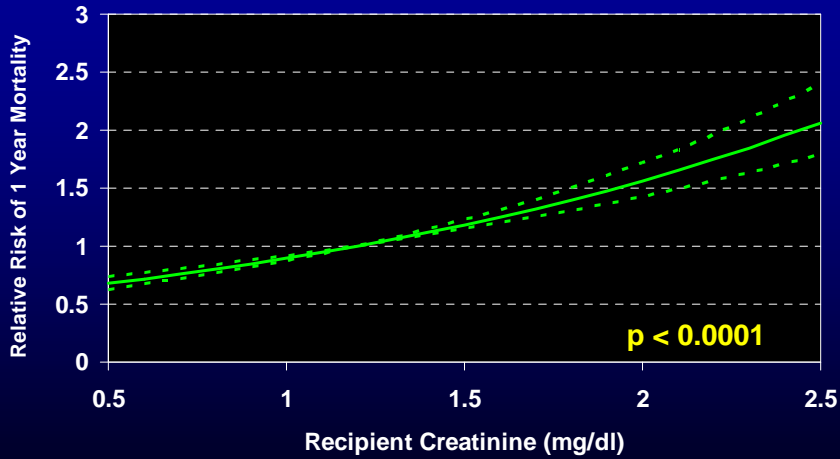
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**ADULT HEART TRANSPLANTS** (1/2004-6/2009)  
 Relative Risk of 1 Year Mortality with 95% Confidence Limits  
**Pre-Transplant Creatinine**



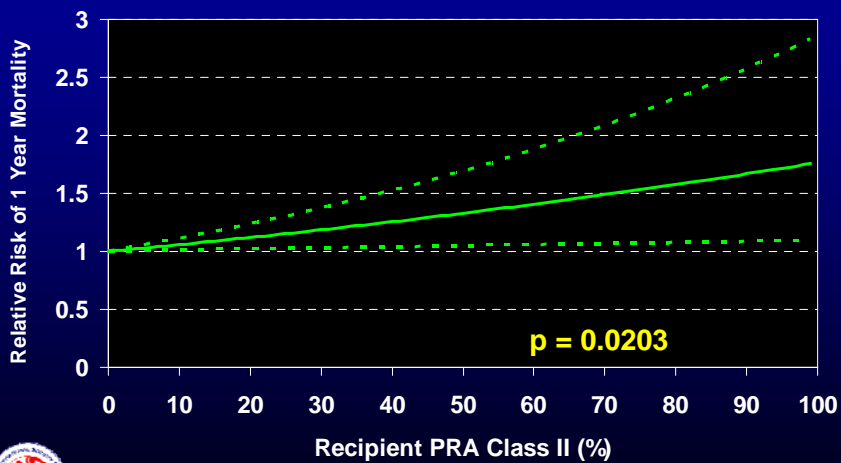
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**(N=10,271)**

**ADULT HEART TRANSPLANTS** (1/2004-6/2009)  
 Relative Risk of 1 Year Mortality with 95% Confidence Limits  
**PRA Class II (%)**



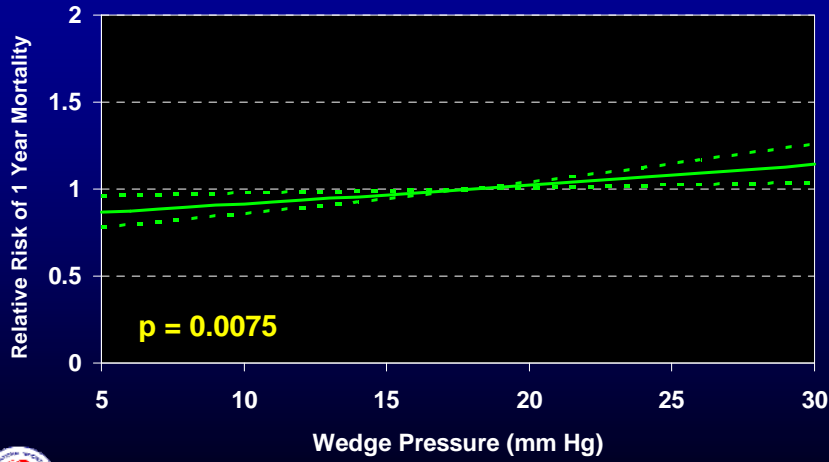
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**(N=10,271)**

**ADULT HEART TRANSPLANTS** (1/2004-6/2009)  
 Relative Risk of 1 Year Mortality with 95% Confidence Limits  
**Pulmonary Capillary Wedge Pressure**



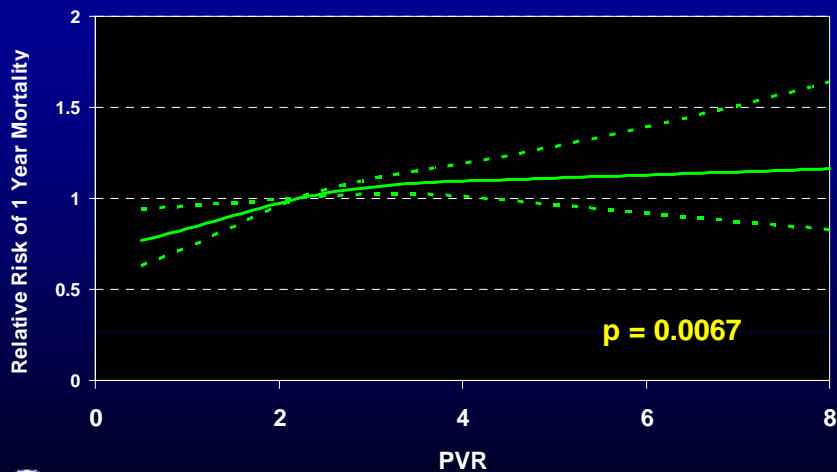
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**(N=10,271)**

**ADULT HEART TRANSPLANTS** (1/2004-6/2009)  
 Relative Risk of 1 Year Mortality with 95% Confidence Limits  
**Recipient PVR**



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**(N=10,271)**

## ADULT HEART TRANSPLANTS (1/2004-6/2009)

### Factors Not Significant for 1 Year Mortality

**Recipient Factors:** Prior malignancy, hospitalized, prior pregnancy, balloon pump, diabetes, gender

**Donor Factors:** Clinical infection, history of diabetes, gender, history of hypertension, cause of death, history of malignancy

**Transplant Factors:** HLA mismatch, CMV mismatch, prior transplant



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