

CHAPTER 2

CORNEAL TRANSPLANTATION

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2.0 INTRODUCTION

Corneal transplantation surgery allows restoration of vision in patients with corneal blindness. Corneal transplantation in Malaysia dates back to the 1970's. Today it is performed by ophthalmologists both in the government and private sectors with each centre contributing data towards the National Transplant Registry.

The National Transplant Registry (NTR) was established in December 2003. The corneal transplant section of the NTR is a systematic centralised data collection of all corneal transplantations performed in the country.

A total of 46 centres registered and agreed to provide information on retrospective and prospective corneal transplant activities. A total of 75 contributing surgeons participated in the NTR – Corneal Transplant section. Participation was on a voluntary basis.

Retrospective data (from 1998 to 2003) on corneal transplant activities were collected to identify the trend of corneal transplant surgery in the recent past. **Prospective data** (from the year 2004) on corneal transplant activities involved gathering information on all cornea transplants performed in Malaysia on two forms. The first form is the i) **Corneal Transplant Notification Form (Form N-cds)** which is completed at the time of surgery and gathers information on the recipient, operative procedure and the donor. The second form is the ii) **Corneal Transplant Outcome Form (Form O-cds)** which is completed at the end of 12 months and annually thereafter. Follow-up only ceases upon failure of graft, death or loss to follow-up of the patient.

The Corneal section of the NTR will be discussed under 5 sections.

Section 2.1 and **Section 2.2** cover notification data on corneal transplantation over 12 years from 1998 to 2009. Effort was made to ensure that all cases of corneal transplantation were reported. To the best of our knowledge, this report provides information on all corneal transplants performed in the country.

Section 2.3 covers prospective notification data on corneal transplantation performed (from 2004 onwards)

Section 2.4 covers prospective outcome data on corneal transplantation performed (from 2004 onwards).

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2.1 CORNEAL TRANSPLANT ACTIVITIES AND TRENDS (1998 – 2010)

The annual number of corneal transplants performed between 1998 and 2010 ranged from 119 to 231. In 2010 the number of cases reported was 171 (Table 2.1.1). Penetrating keratoplasty was the most frequent type of transplant surgery performed (Table 2.1.2).

Table 2.1.1: Number of Corneal Transplantation and Transplant Rate per million population (pmp), 1998-2010

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
No. of new transplants	119	122	126	221	203	165	184	192	177	196	231	209	171
New transplant rate, pmp	5	5	5	9	8	7	7	7	7	7	8	7	6

Table 2.1.2: Types of Corneal Transplant, 1998-2010

Surgery type	1998 (N=119)		1999 (N=122)		2000 (N=126)		2001 (N=221)		2002 (N=203)		2003 (N=165)		2004 (N=184)		2005 (N=192)		2006 (N=177)		2007 (N=196)		2008 (N=231)		2009 (N=209)		2010 (N=171)		TOTAL (N=2316)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Penetrating Keratoplasty	114	96	116	95	120	95	207	94	196	97	156	94	165	90	173	90	153	86	175	89	189	82	173	83	122	71	2059	89
Lamellar Keratoplasty	1	1	5	4	4	3	14	6	5	2	8	5	10	5	13	7	16	9	7	4	21	9	15	7	16	9	135	6
Patch Graft for Corneal	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	1	5	3	10	5	12	5	9	4	18	11	59	3
Patch Graft for Sclera	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	2	1	2	1	0	0	5	0
Cornea Scleral Keratopalsty	0	0	1	1	0	0	0	0	0	0	1	1	7	4	2	1	3	2	4	2	4	2	10	5	8	5	40	2
Endothelial keratoplasty	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	7	4	10	0
No Data	4	3	0	0	2	2	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0

2.2 RECIPIENTS' CHARACTERISTICS

There was a preponderance of male recipients every year and this ranged from 60 % to 69% (Table 2.2.1). Ethnic Chinese (37%) were the predominant race undergoing corneal transplant surgery followed by Malays (33%) and Indians (21%) (Table 2.2.2). The mean age was 45 years (SD 21) with a range from as young as 2 months of age to as old as 102 years (Table 2.2.3).

The commonest primary indication for surgery was keratoconus (16%) followed by corneal scar (13%) and pseudophakic bullous keratopathy (14%). (Table 2.2.4). There may be one or more indications for corneal transplant surgery. The most frequent indication was *optical*. There were an equal number of *tectonic* and *therapeutic* indications (Table 2.2.5).

Table 2.2.1: Gender Distribution, 1998-2010

Year	1998 (N=119)		1999 (N=122)		2000 (N=126)		2001 (N=221)		2002 (N=203)		2003 (N=165)		2004 (N=184)		2005 (N=192)		2006 (N=177)		2007 (N=196)		2008 (N=231)		2009 (N=209)		2010 (N=171)		TOTAL (N=2316)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Male	78	66	80	66	81	64	142	64	122	60	114	69	112	61	115	60	118	67	129	66	143	62	132	63	117	68	1483	64
Female	41	34	42	34	45	36	79	36	81	40	51	31	72	39	77	40	59	33	67	34	88	38	77	37	54	32	833	36

Table 2.2.2: Ethnic Distribution, 1998-2010

Year	1998 (N=119)		1999 (N=122)		2000 (N=126)		2001 (N=221)		2002 (N=203)		2003 (N=165)		2004 (N=184)		2005 (N=192)		2006 (N=177)		2007 (N=196)		2008 (N=231)		2009 (N=209)		2010 (N=171)		TOTAL (N=2316)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Malay	28	24	34	28	41	32	70	32	74	37	52	31	66	36	62	32	60	34	64	33	79	34	61	29	69	40	760	33
Chinese	47	39	46	38	50	40	92	42	83	41	67	41	58	31	73	38	59	33	70	36	84	36	69	33	48	28	846	37
Indian	36	30	35	28	28	22	49	22	35	17	34	21	43	23	41	21	40	23	38	19	41	18	58	28	22	13	500	21
Bumiputra Sabah	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	3	2	2	1	2	1	3	1	6	4	18	1
Bumiputra Sarawak	0	0	0	0	0	0	1	0	0	0	0	0	4	2	5	3	4	2	4	2	7	3	6	3	4	2	35	1
Others	8	7	7	6	7	6	9	4	11	5	12	7	12	7	10	5	11	6	18	9	18	8	12	6	22	13	157	7

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Table 2.2.3: Age Distribution of Corneal Transplant Recipient Patients, 1998-2010

Year	1998 (N=119)		1999 (N=122)		2000 (N=126)		2001 (N=221)		2002 (N=203)		2003 (N=165)		2004 (N=184)		2005 (N=192)		2006 (N=177)		2007 (N=196)		2008 (N=231)		2009 (N=209)		2010 (N=171)		TOTAL (N=2316)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0-9	4	3	5	4	6	5	8	4	9	4	6	3	6	3	8	4	7	4	4	2	5	2	6	3	15	9	89	4
10-19	13	11	17	14	9	7	29	13	16	8	21	13	15	8	14	7	23	13	13	7	20	9	27	13	14	8	231	10
20-39	28	24	34	28	34	27	49	22	53	26	36	22	55	30	59	31	53	30	48	24	68	29	54	26	43	25	614	26
40-59	38	32	32	26	40	32	61	28	57	28	51	31	52	28	45	24	41	23	66	34	69	30	64	30	52	30	668	29
≥60	36	30	34	28	37	29	74	33	68	34	51	31	56	31	66	34	53	30	65	33	69	30	58	28	47	28	714	31
Mean	45		43		44		45		46		45		45		46		44		47		46		44		42		45	
SD	21		22		20		21		21		21		21		21		22		21		20		20		21		21	
Median	45		43		45		50		46		46		44		49		43		49		48		45		45		46	
Minimum	4 month		5		2 months		5 month		1		5 month		2 month		2 month		2 month		3		1		3		5month		2 month	
Maximum	82		92		86		85		86		84		86		84		96		102		87		86		81		102	

Table 2.2.4: Diagnosis, 1998-2010

Year	1998 (N=119)		1999 (N=122)		2000 (N=126)		2001 (N=221)		2002 (N=203)		2003 (N=165)		2004 (N=184)		2005 (N=192)		2006 (N=177)		2007 (N=196)		2008 (N=231)		2009 (N=209)		2010 (N=171)		TOTAL (N=2316)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Primary Diagnosis	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Keratoconus	24	20	24	20	15	12	38	17	32	16	18	11	34	18	34	18	33	19	28	14	37	16	46	22	13	8	376	16
Corneal scar	33	28	25	20	21	17	34	15	28	14	21	13	26	14	20	10	18	10	25	13	29	13	14	7	17	10	311	13
Microbial keratitis	11	9	11	9	19	15	30	14	31	15	21	13	18	10	13	7	11	6	14	7	18	8	19	9	22	13	238	10
Microbial keratitis+Cornea perforation	1	1	6	5	1	1	6	3	4	2	4	2	17	9	20	10	7	4	10	5	12	5	28	13	25	15	141	6
Corneal perforation (non microbial)	6	5	7	6	8	6	12	5	12	6	27	16	13	7	18	9	20	11	21	11	18	8	19	9	34	20	215	9
Pseudophakic Bullous keratopathy	10	8	16	13	17	13	23	10	15	7	19	12	19	10	35	18	30	17	36	18	46	20	28	13	23	13	317	14
Other (non pseudophakic) bullous keratopathy	14	12	4	3	19	15	37	17	47	23	25	15	16	9	14	7	11	6	8	4	14	6	8	4	11	6	228	10
Failed previous graft	14	12	12	10	13	10	17	8	15	7	14	8	12	7	14	7	10	6	23	12	16	7	12	6	9	5	181	8
Corneal dystrophy	5	4	6	5	5	4	12	5	9	4	7	4	8	4	6	3	10	6	12	6	10	4	17	8	4	2	111	5
Congenital opacity	1	1	1	1	1	1	1	0	0	0	1	1	8	4	4	2	1	1	1	1	5	2	2	1	2	1	28	1
Others	3	3	8	7	7	6	15	7	14	7	10	6	34	18	34	18	36	20	39	20	48	21	29	14	24	14	301	13
No data	0	0	2	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	4	2	0	0	0	0	0	0	8	0

* Each patient may have more than one diagnosis.

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Table 2.2.5: Indications of Corneal Transplant, 2004-2010

Indication of transplant	2004 (N=184)		2005 (N=192)		2006 (N=177)		2007 (N=196)		2008 (N=231)		2009 (N=209)		2010 (N=171)		TOTAL (N=1360)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Optical	120	65	135	70	124	70	139	71	154	66	101	48	67	39	840	62
Tectonic	26	14	23	12	20	11	17	8	25	11	25	12	34	20	170	13
Therapeutic	27	14	19	10	17	9	24	12	24	10	44	21	27	16	182	13
Tectonic+Therapeutic	9	5	9	4	4	2	8	4	6	2	22	11	22	13	80	6
Optical+Tectonic	1	1	1	1	1	1	0	0	1	1	0	0	0	0	4	0
Optical+Tectonic+Therapeutic	0	0	1	1	0	0	1	1	1	1	2	1	0	0	5	0
Optical+Therapeutic	0	0	0	0	5	3	6	3	8	3	7	3	8	4	34	3
Optical+Others	0	0	0	0	1	1	0	0	1	1	0	0	1	1	3	0
Therapeutic+Others	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0
Others	1	1	4	2	5	3	1	1	10	4	7	3	12	7	40	3
No data	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0

* Each patient may have more than one indication.

2.3 TRANSPLANT DATA, 2004-2010

2.3.1 Recipient Data

Regrfts were performed in 11% of cases (Table 2.3.1.1). Ocular co-morbidity was noted in 55% of the patients. (Table 2.3.1.2). From data available 67% of the eyes had a vision of 3/60 or worse prior to corneal transplantation (Table 2.3.1.3).

Table 2.3.1.1: No of Previous Grafts in Grafted Eye, 2004-2010

Year	2004* (N=138)		2005 (N=192)		2006 (N=177)		2007 (N=196)		2008 (N=231)		2009 (N=209)		2010 (N=171)		TOTAL (N=1314)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0	123	89	174	90	160	90	161	82	204	88	191	91	150	87	1163	89
1	11	8	15	8	15	8	30	15	22	10	12	6	14	8	119	9
2	3	2	2	1	1	1	4	2	5	2	5	2	5	3	25	2
3	0	0	1	1	1	1	0	0	0	0	0	0	1	1	3	0
4	1	1	0	0	0	0	1	1	0	0	0	0	1	1	3	0
Not Available	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0

*In the year 2004 there are total of 185 corneal transplants performed but complete data set was only received for 138 patients.

Table 2.3.1.2: Ocular Co-morbidity, 2004-2010

Year	2004* (N=138)		2005 (N=192)		2006 (N=177)		2007 (N=196)		2008 (N=231)		2009 (N=209)		2010 (N=171)		TOTAL (N=1314)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Ocular co-morbidity																
Any ocular co-morbidity (a to d below)	88	64	103	54	82	46	89	45	126	55	118	56	114	67	720	55
a) Superficial corneal vascularisation	44	50	48	47	44	54	53	60	70	56	62	53	57	50	378	53
b) Deep corneal vascularisation	43	49	39	38	22	27	28	31	31	25	38	32	32	28	233	32
c) History of glaucoma	29	33	36	35	36	44	39	44	68	54	54	46	53	46	315	44
d) Current ocular inflammation	42	48	50	49	41	50	39	44	66	52	63	53	70	61	371	52

*Patient might have multiple ocular co-morbidities.

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Table 2.3.1.3: Pre-operative Vision, 2004-2010

Year	2004* (N=138)		2005 (N=192)		2006 (N=177)		2007 (N=196)		2008 (N=231)		2009 (N=209)		2010 (N=171)		TOTAL (N=1314)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Unaided VA																
6/6	3	2	0	0	1	1	1	1	1	1	1	1	1	1	8	1
6/9	1	1	1	1	1	1	2	1	7	3	3	1	1	1	16	1
6/12	0	0	2	1	3	1	0	0	2	1	2	1	1	1	10	1
6/18	0	0	1	1	0	0	2	1	1	1	3	1	5	3	12	1
6/24	3	2	5	2	4	2	2	1	3	1	4	2	7	4	28	2
6/36	4	3	6	3	5	3	3	1	6	2	6	3	6	3	36	3
6/60	7	5	16	8	17	10	11	5	14	6	17	8	12	7	94	7
5/60	1	1	0	0	0	0	0	0	0	0	1	1	1	1	3	0
4/60	3	2	1	1	2	1	2	1	0	0	0	0	3	2	11	1
3/60	2	2	2	1	1	1	4	2	5	2	5	2	0	0	19	1
2/60	1	1	2	1	4	2	1	1	2	1	4	2	1	1	15	1
1/60	4	3	9	4	7	4	2	1	1	1	6	3	2	1	31	2
CF	47	34	47	24	45	25	44	22	40	17	76	36	51	29	350	27
HM	47	34	46	24	37	21	48	24	48	21	61	29	49	28	336	26
PL	13	9	15	8	12	7	17	9	20	8	17	8	23	13	117	9
NPL	2	1	1	1	0	0	1	1	0	0	2	1	2	1	8	1
Others	0	0	0	0	0	0	0	0	0	0	1	1	3	2	4	0
No Data	0	0	38	20	38	21	56	29	81	35	0	0	3	2	216	16

2.3.2: Donor details

Eye Banks in the United States of America (USA) were the most frequent source of the corneal tissues (Table 2.3.2.1). The majority of donors were elderly patients with a median age of 59 years (Table 2.3.2.2). Optisol GS was the commonest corneal tissue storage medium used at 79% (Table 2.3.2.3). The major cause of death of the donors were related to the cardiac/circulatory system (30%) followed by malignancy (15%) (Table 2.3.2.4).

Table 2.3.2.1: Source of Donor Cornea Tissue, 2004-2010

Year	2004* (N=138)		2005 (N=192)		2006 (N=177)		2007 (N=196)		2008 (N=231)		2009 (N=209)		2010 (N=171)		TOTAL (N=1314)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Local	21	15	19	10	36	20	31	16	41	18	41	20	51	30	240	18
USA	95	69	133	69	98	56	114	58	151	65	130	62	108	63	829	63
Sri Lanka	22	16	38	20	41	23	51	26	37	16	38	18	11	6	238	18
Others	0	0	0	0	2	1	0	0	2	1	0	0	1	1	5	1
No data	0	0	2	1	0	0	0	0	0	0	0	0	0	0	2	0
If Local, ethnic group:																
• Malay	0	0	4	21	1	3	5	16	0	0	0	0	0	0	10	4
• Chinese	15	71	8	42	12	33	16	52	22	54	29	71	32	63	134	56
• Indian	6	29	7	37	23	64	4	13	9	22	12	29	18	35	79	33
• Others	0	0	0	0	0	0	4	13	10	24	0	0	0	0	14	6
• Unknown	0	0	0	0	0	0	2	6	0	0	0	0	1	2	3	1

* In the year 2004 there were a total of 184 corneal transplants performed but complete data set was only received for 138 patients.

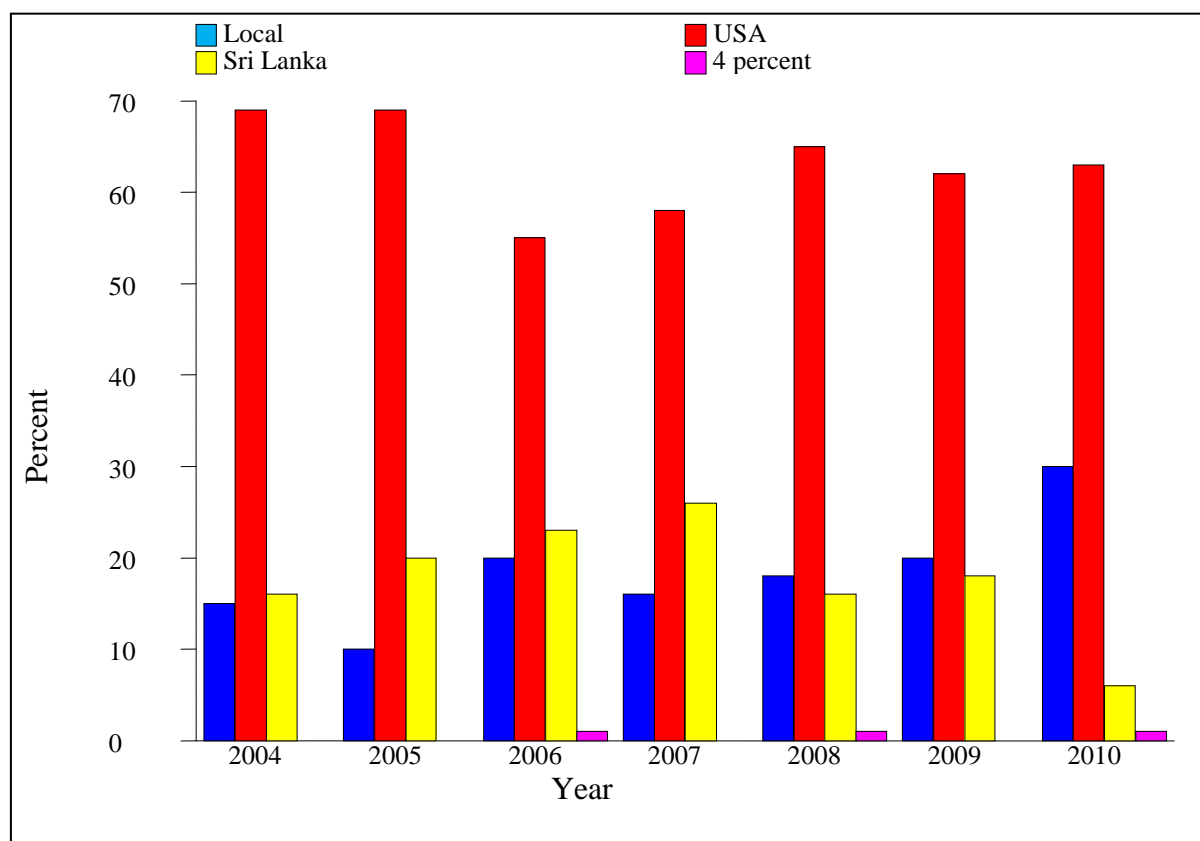


Figure 2.3.2.1: Source of Donor Corneal Tissue, 2004-2010

CORNEAL TRANSPLANTATION

Table 2.3.2.2: Donor Age Distribution, 2004-2010

Year	2004* (N=138)		2005 (N=192)		2006 (N=177)		2007 (N=196)		2008 (N=231)		2009 (N=209)		2010 (N=171)		TOTAL (N=1314)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Age group (years)																
0-9	2	2	3	2	2	1	2	1	7	3	2	1	1	1	19	1
10-19	6	4	4	2	9	5	5	3	7	3	9	4	7	4	47	4
20-39	11	8	7	4	11	6	13	7	19	8	17	8	21	12	99	8
40-59	51	37	89	46	81	46	83	42	80	35	85	41	73	43	542	41
≥60	68	49	89	46	74	42	93	47	118	51	96	46	69	40	607	46
Mean	57		58		56		57		56		56		53		56	
SD	15		14		16		14		17		16		17		16	
Median	59		58		56		59		60		58		57		59	
Minimum	8		3		6		4		1		1		2		1	
Maximum	78		79		78		78		76		77		75		79	

Table 2.3.2.3: Preservation Media, 2004-2010

Year	2004* (N=138)		2005 (N=192)		2006 (N=177)		2007 (N=196)		2008 (N=231)		2009 (N=209)		2010 (N=171)		TOTAL (N=1314)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Preservation media																
Optisol GS	90	65	147	77	128	72	134	68	191	83	185	89	160	94	1035	79
MK Medium	22	16	38	20	40	23	51	26	35	15	15	7	11	6	212	16
Moist Chamber	4	3	3	1	7	4	11	6	5	2	8	4	0	0	38	3
Others*	0	0	1	1	0	0	0	0	0	0	1	0	0	0	2	0
No data	22	16	3	1	2	1	0	0	0	0	0	0	0	0	27	2

*Others (specify) Eusol-C

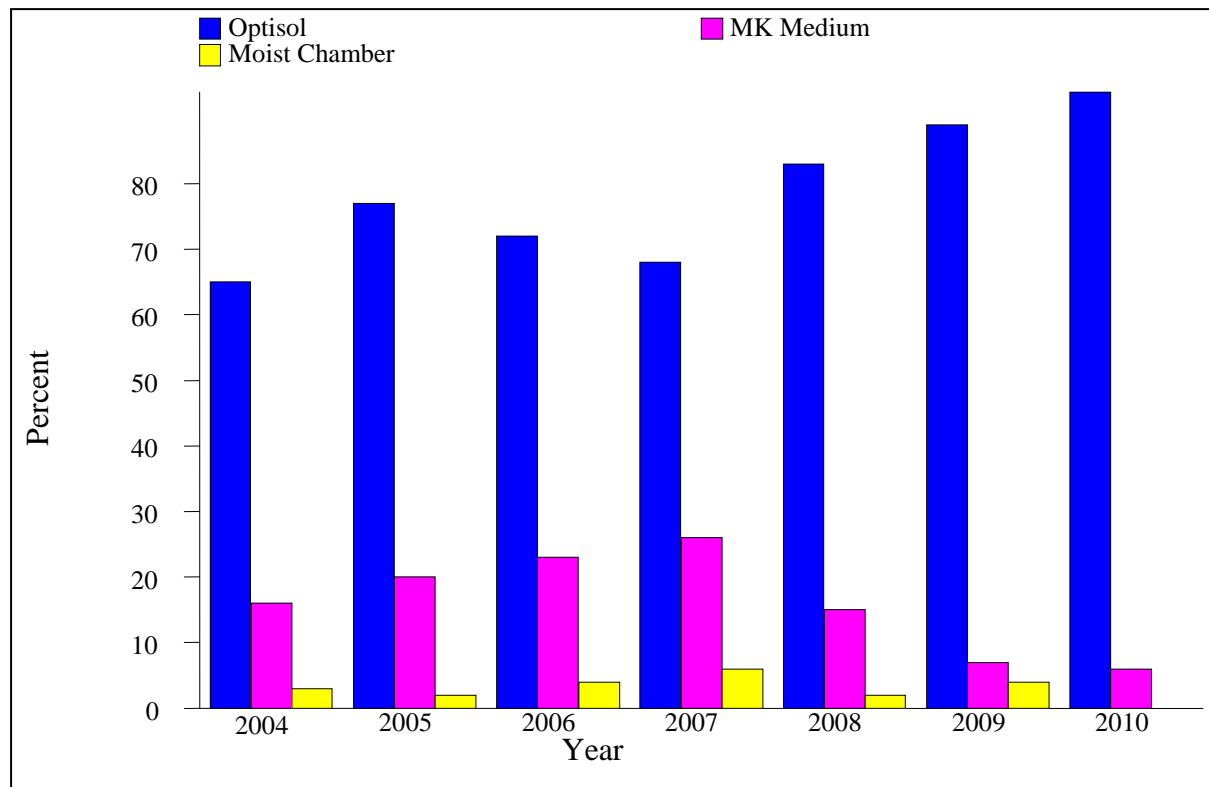


Figure 2.3.2.3: Preservation Media, 2004-2010

Table 2.3.2.4: Cause of Death in Corneal Donors, 2004-2010

Year	2004* (N=138)		2005 (N=192)		2006 (N=177)		2007 (N=196)		2008 (N=231)		2009 (N=209)		2010 (N=171)		TOTAL (N=1314)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Cardiac / Circulatory System	47	34	49	26	59	33	75	38	61	26	58	28	44	26	393	30
Cerebrovascular System	17	12	25	13	11	6	23	12	35	15	18	9	20	12	149	11
Malignancy	19	14	31	16	25	14	26	13	41	18	27	13	24	14	193	15
Trauma / Accident	20	15	13	7	19	11	24	12	21	9	28	13	33	19	158	12
Respiratory System	15	11	8	4	8	5	13	7	10	4	25	12	18	11	97	7
Others	17	12	21	11	27	15	32	16	59	26	49	23	30	18	235	18
No data	3	2	45	23	28	16	3	2	4	2	4	2	4	2	91	7

*May have more than one cause of Death in Corneal Donors

2.3.3: Transplant Practices

Penetrating Keratoplasty (PK) was the commonest type of surgery performed (84%) (Table 2.3.3.1). Corneal transplantation was performed in combination with other surgical procedures in 18% of cases. Cataract extraction, with or without intraocular lens implantation (IOL), was the commonest combined procedure (Table 2.3.3.2). The recipient graft size ranged from 2mm to 12mm, with the median recipient cornea graft size being 7.5mm. (Table 2.3.3.3). The majority of cases had the donor tissue over-sized by 0.5mm (Table 2.3.3.4). The commonest suturing technique was interrupted sutures (Table 2.3.3.5).

Table 2.3.3.1: Types of Surgeries, 2004-2010

Year	2004* (N=138)		2005 (N=192)		2006 (N=177)		2007 (N=196)		2008 (N=231)		2009 (N=209)		2010 (N=171)		TOTAL (N=1314)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Penetrating Keratoplasty	120	87	173	90	153	86	175	89	189	82	173	83	122	71	1105	84
Lamellar Keratoplasty	10	7	13	7	16	9	7	4	21	9	15	7	16	9	98	7
Patch Graft for Corneal	2	2	3	1	5	3	10	5	12	5	9	4	18	11	59	5
Patch Graft for Scleral	0	0	1	1	0	0	0	0	2	1	2	1	0	0	5	0
Cornea Scleral Keratoplasty	6	4	2	1	3	2	4	2	4	2	10	5	8	5	37	3
Endothelial keratoplasty	0	0	0	0	0	0	0	0	3	1	0	0	7	4	10	1
Others	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

* In the year 2004 there were a total of 184 corneal transplants performed but complete data set was only received for 138 patients.

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Table 2.3.3.2: Types of Combined Surgeries, 2004-2010

Year	2004* (N=138)		2005 (N=192)		2006 (N=177)		2007 (N=196)		2008 (N=231)		2009 (N=209)		2010 (N=171)		TOTAL (N=1314)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Combined surgeries																
No. of patients with corneal transplant surgery combined with another surgical procedure	30	22	27	14	41	23	35	18	46	20	32	15	27	16	238	18
(a) Glaucoma surgery	2	7	3	11	1	2	0	0	3	7	2	6	0	0	11	5
(b) Cataract Extraction	15	50	13	48	21	51	13	37	17	37	15	47	16	59	110	46
(c) IOL	13	43	10	37	24	59	19	54	23	50	10	31	5	19	104	44
(d) Cataract extraction and IOL	9	30	8	30	15	37	10	29	16	35	9	28	4	15	71	30
(e) Retinal Surgery ± Internal Tamponade	1	3	1	4	2	5	4	11	10	22	0	0	0	0	18	8
(f) Anterior vitrectomy	9	30	3	11	4	10	10	29	6	13	9	28	6	22	47	20
(g) Others	5	17	8	30	8	20	16	46	14	30	11	34	7	26	69	29

*Patients may have more than one combined surgery.

Table 2.3.3.3: Recipient Cornea Trephine Size, 2004-2010

Year	2004 (N=138)		2005 (N=192)		2006 (N=177)		2007 (N=196)		2008 (N=231)		2009 (N=209)		2010 (N=171)		TOTAL (N=1314)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Graft size, mm																
<6mm	3	2	4	2	4	2	7	4	4	2	7	3	27	16	56	4
6-9mm	124	90	105	55	102	58	134	68	165	71	187	90	126	73	943	72
>9mm	1	1	2	1	0	0	0	0	5	2	8	4	7	4	23	2
Not Applicable*	0	0	0	0	2	1	1	1	0	0	3	1	1	1	7	1
No data	10	7	81	42	69	39	54	27	57	25	4	2	10	6	285	21
Mean	7.5		7.3		7.2		7.3		7.5		7.5		7		7.3	
SD	0.9		1		1		1.1		0.9		1.1		1.6		1.1	
Median	7.5		7.3		7.3		7.5		7.5		7.5		7.4		7.5	
Minimum	2		2		2		2		3		2		2		2	
Maximum	10		9.5		9		9		12		11		12		12	

- No Cases of tissue was cut “Free-Hand”

Table 2.3.3.4: Difference in Trephined Sizes of Recipient and Donor Corneas, 2004-2010

Year	2004 (N=138)		2005 (N=192)		2006 (N=177)		2007 (N=196)		2008 (N=231)		2009 (N=209)		2010 (N=171)		TOTAL (N=1314)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Difference in Graft size, mm																
0.25mm	33	24	27	14	38	21	39	20	47	20	90	43	59	35	333	25
0.5mm	92	67	84	44	66	37	95	48	117	51	100	48	89	52	643	49
0.75mm	0	0	0	0	1	1	1	1	4	2	1	0	0	0	7	1
1.00mm	2	1	0	0	1	1	4	2	2	1	6	3	10	6	25	2
>1.00mm	1	1	0	0	0	0	0	0	1	0	1	0	1	1	4	0
Not Applicable	9	7	5	3	9	5	6	3	8	3	6	3	3	2	46	4
No data	1	1	76	40	62	35	51	26	52	23	5	2	9	5	256	19

Table 2.3.3.5: Suture Technique, 2004-2010

Year	2004 (N=138)		2005 (N=192)		2006 (N=177)		2007 (N=196)		2008 (N=231)		2009 (N=209)		2010 (N=171)		TOTAL (N=1314)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Suture Technique																
Interrupted only	132	96	139	73	124	70	138	70	171	74	175	84	152	89	1031	78
Continuous only	0	0	0	0	5	3	1	1	6	3	7	3	5	3	24	2
Combined	6	4	18	9	18	10	12	6	10	4	26	12	10	6	100	8
No data	0	0	35	18	30	17	45	23	44	19	1	1	4	2	159	12

2.4 CORNEAL TRANSPLANT OUTCOME 2004-2010

Table 2.4.1: Stock and Flow - Graft Status (Whole Database)

		Optical		Non optical		Total	
		No.	%	No.	%	No.	%
Number registered		886	65	474	35	1360	100
Number followed		Total	404	221		625	
	1 year	228	56	167	76	395	63
	2 year	83	21	31	14	114	18
	3 year	47	12	7	3	54	9
	4 year	22	5	10	5	32	5
	5 year	17	4	5	2	22	4
	6 year	7	2	1	0	8	1
Graft status		Total	404	221		625	
	-Surviving graft	318	79	125	57	443	71
	-Failed graft	86	21	96	43	182	29
Recipient status		Total	886	474		1360	
	-Recipient with complete follow up	177	20	132	27	309	23
	-Recipient deaths	4	1	1	1	5	1
	-Recipient loss - followed	220	25	86	18	306	22
	-Recipient loss - not followed	412	45	161	34	573	42
	-Graft not yet followed (Transplant duration less than 1 year)	73	8	94	20	167	12

2.4.2 Outcome – Graft Survival 2004-2010

Graft survival for both optical and non-optical indications at 12 months was 77.5% but this declined to 67% at 36 months (Table 2.4.2.1). The cases were grouped into two groups based on the indication for surgery – i) Optical and ii) Non-Optical. Graft survival was 86.6% at 12 months in the optical group and 60.7% in the non-optical group. This declined to 74% at 36 months in the optical group and 54.6% in the non-optical group (Table 2.4.2.2).

Table 2.4.2.1: Graft Survival, 2004-2010

Interval (months)	No.	% success	SE
0	625	100	-
12	484	77.5	2
24	230	71.7	2
36	116	67.0	2
48	62	60.6	3
60	30	59.00	3

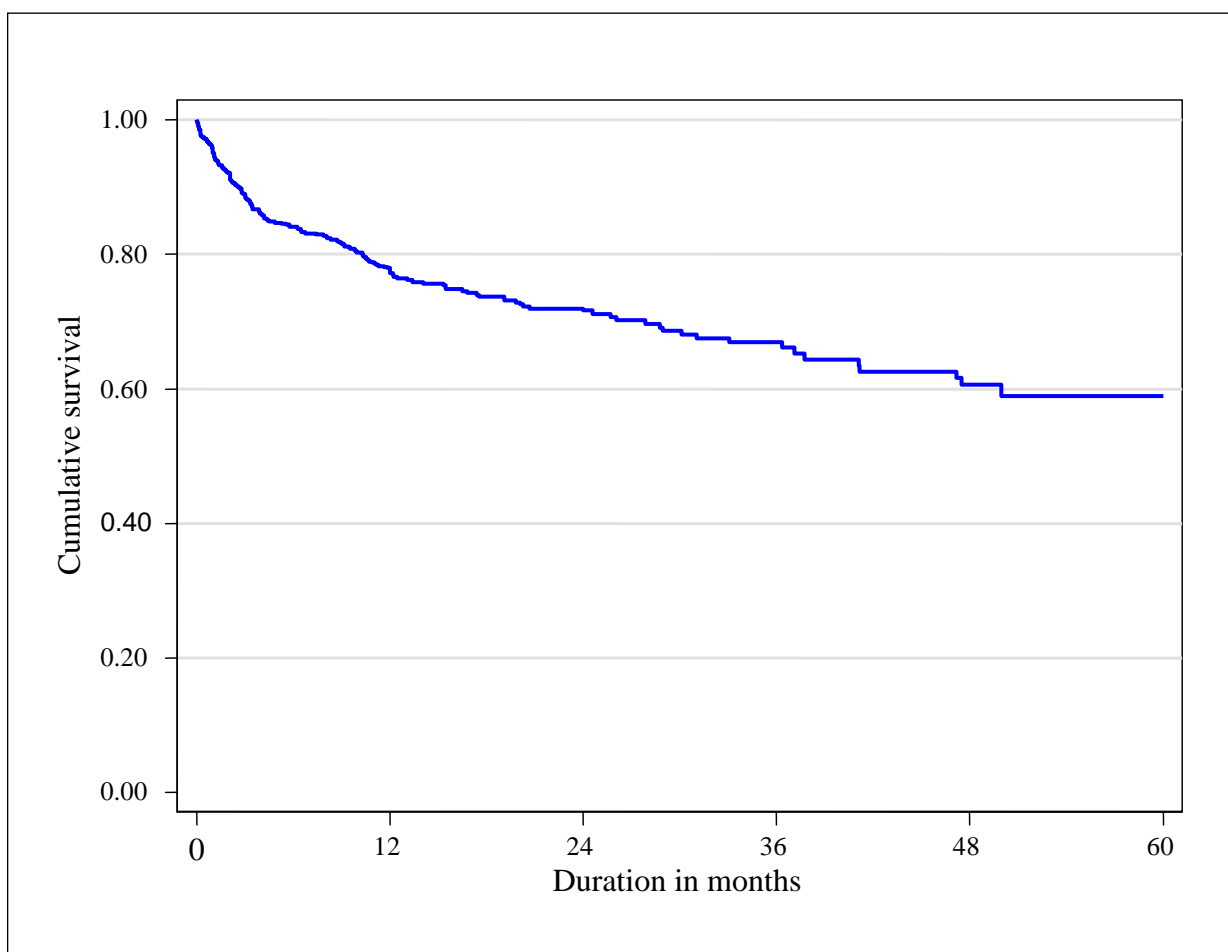


Figure 2.4.2.1: Graft Survival, 2004-2010

Table 2.4.2.2: Graft Survival by Optical and Non-optical Indication, 2004-2010

Interval (months)	Optical			Non-Optical		
	No.	% success	SE	No.	% success	SE
0	404	100	-	221	100	-
12	349	86.6	2	135	60.7	3
24	176	79.9	2	54	56.7	4
36	93	74.0	3	23	54.6	4
48	46	66.1	4	16	51.6	5
60	24	63.8	4	6	51.6	5

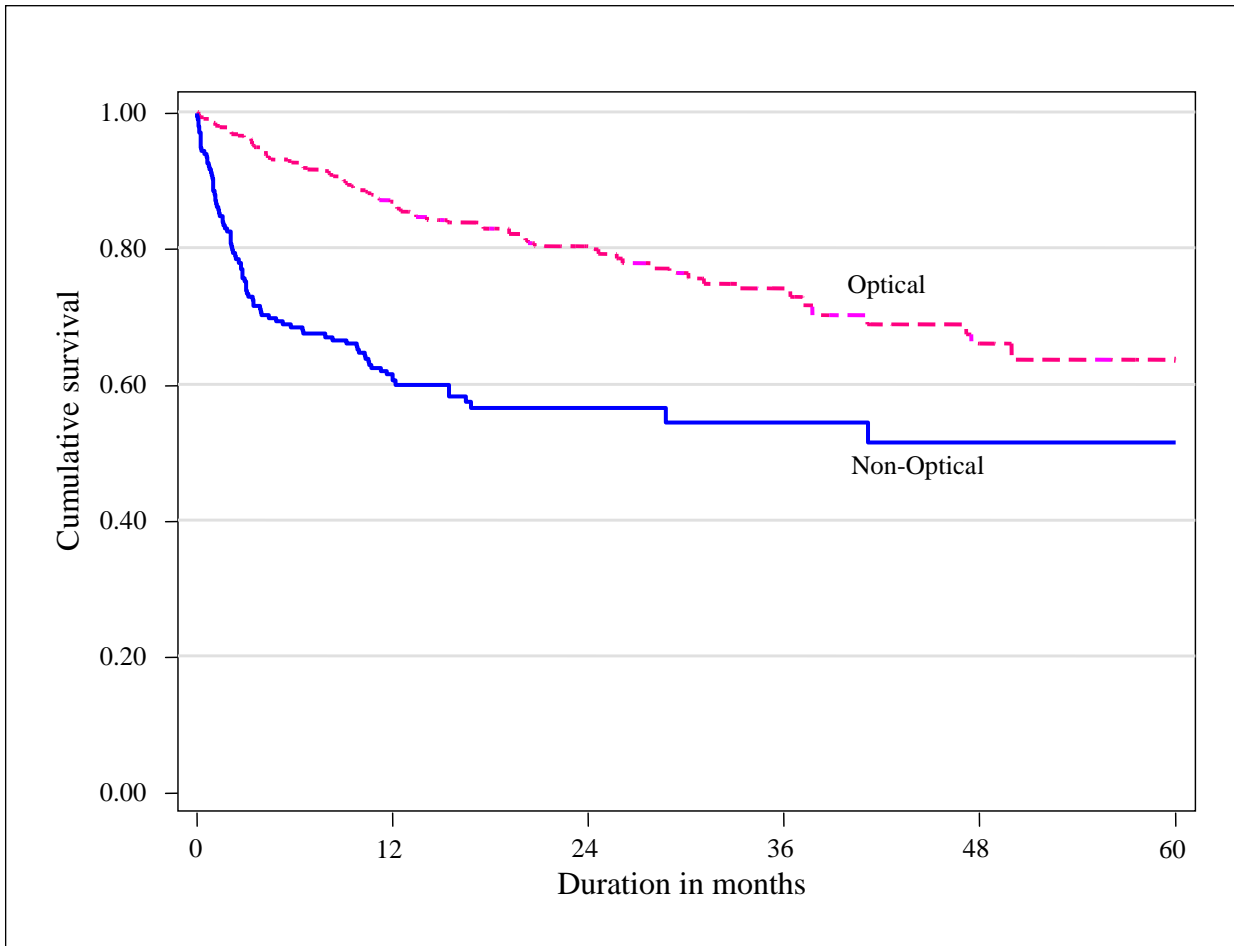


Figure 2.4.2.2: Graft Survival by Optical and Non-optical Indication, 2004-2010

Table 2.4.2.3: Graft Success by Gender, 2004-2010

Interval (months)	Male			Female		
	No.	% success	SE	No.	% success	SE
0	395	100	-	230	100	-
12	305	77.2	2	179	78.1	3
24	134	71.6	3	96	71.8	3
36	68	65.6	3	48	69.2	4
48	37	61.4	4	25	59.8	5
60	20	61.4	4	10	55.2	7

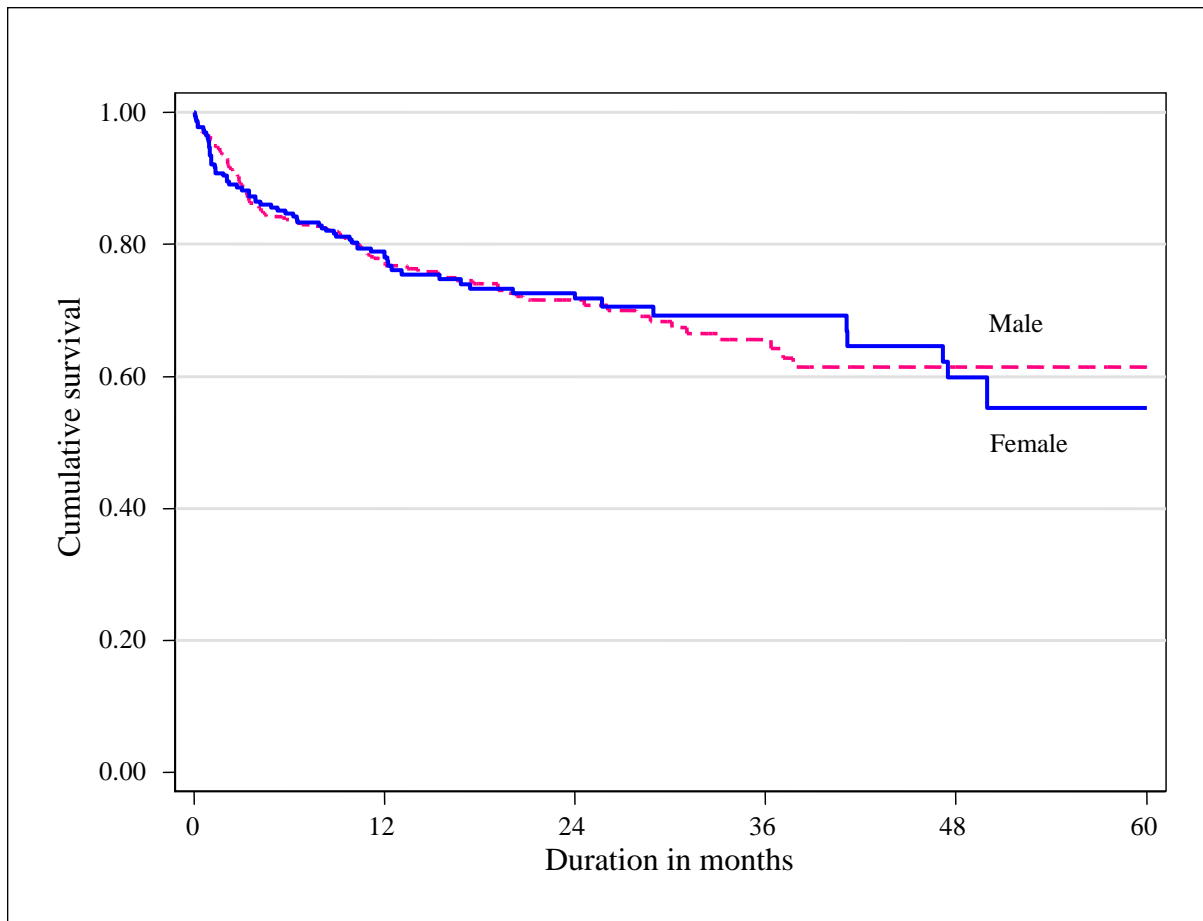


Figure 2.4.2.3: Graft Success by Gender, 2004-2010

Table 2.4.2.4: Graft Survival by Age, 2004-2010

Interval (months)	0-9			10-19		
	No.	% success	SE	No.	% success	SE
0	11	100	-	31	100	-
12	10	90.9	9	27	87.1	6
24	4	54.6	21	19	87.1	6
36	4	54.6	21	16	87.1	6
48	4	54.6	21	5	87.1	6
60	2	54.6	21	1	87.1	6
Interval (months)	20-39			≥40		
	No.	% success	SE	No.	% success	SE
0	42	100	-	541	100	-
12	34	81.0	6	413	76.4	2
24	15	81.0	6	192	70.2	2
36	9	81.0	6	89	64.5	3
48	3	81.0	6	53	57.4	3
	1	81.0	6	26	55.6	4

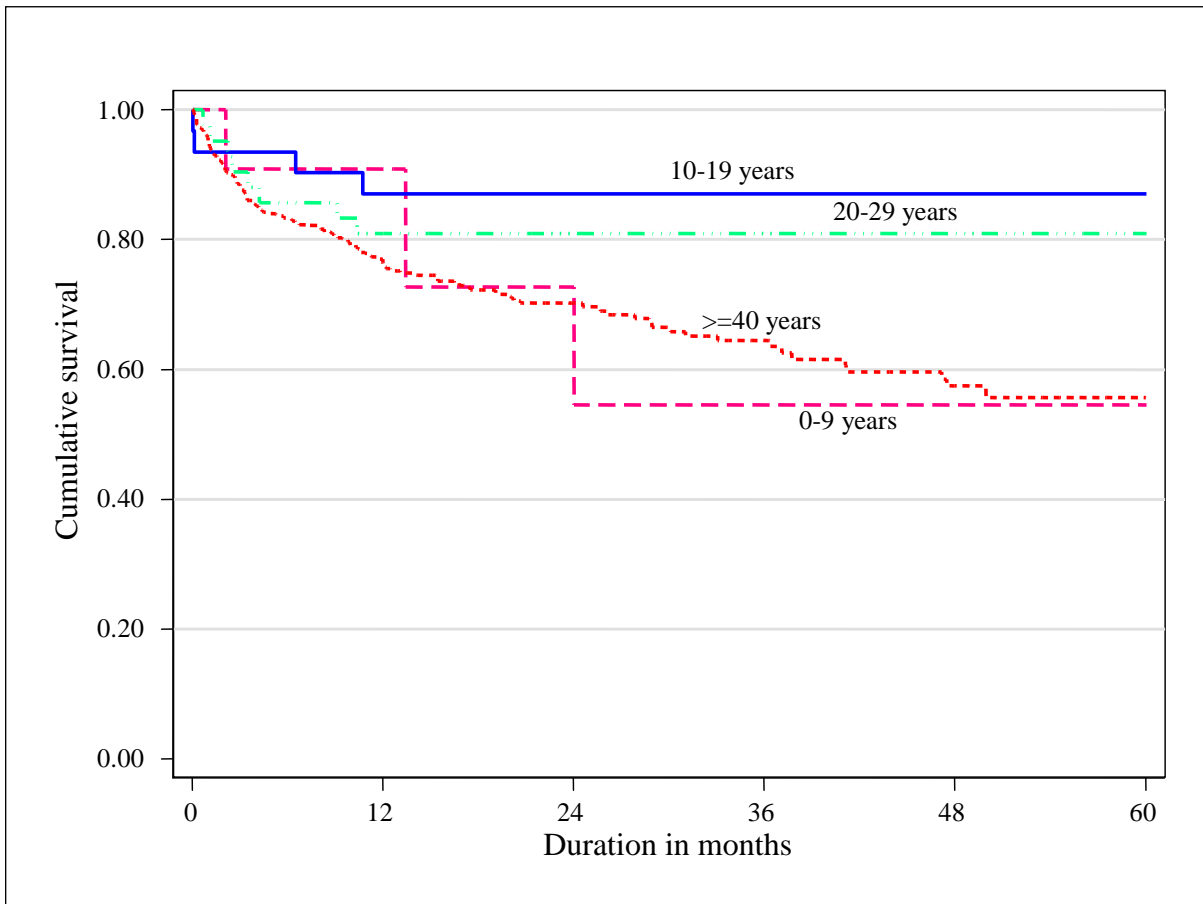


Figure 2.4.2.4: Graft Survival by Age, 2004-2010

2.4.3 Visual Outcome

Table 2.4.3.1: Availability of Data on Post Corneal Transplant Unaided Vision

	Unaided Vision (N =1360)	
	No.	No.
Data available	641	47
Lost to follow up	676	50
No data	43	3

Table 2.4.3.2: Unaided Visual Outcome after Cornea Transplant Surgery

Reason for graft	Optical (n=392)		Non-optical (n=249)	
	No.	%	No.	%
Vision better	201	51	79	32
Vision same	63	16	56	22
Vision worse	68	18	100	40
Not known*	60	15	14	6

*Either pre op vision and/or post op vision is not available

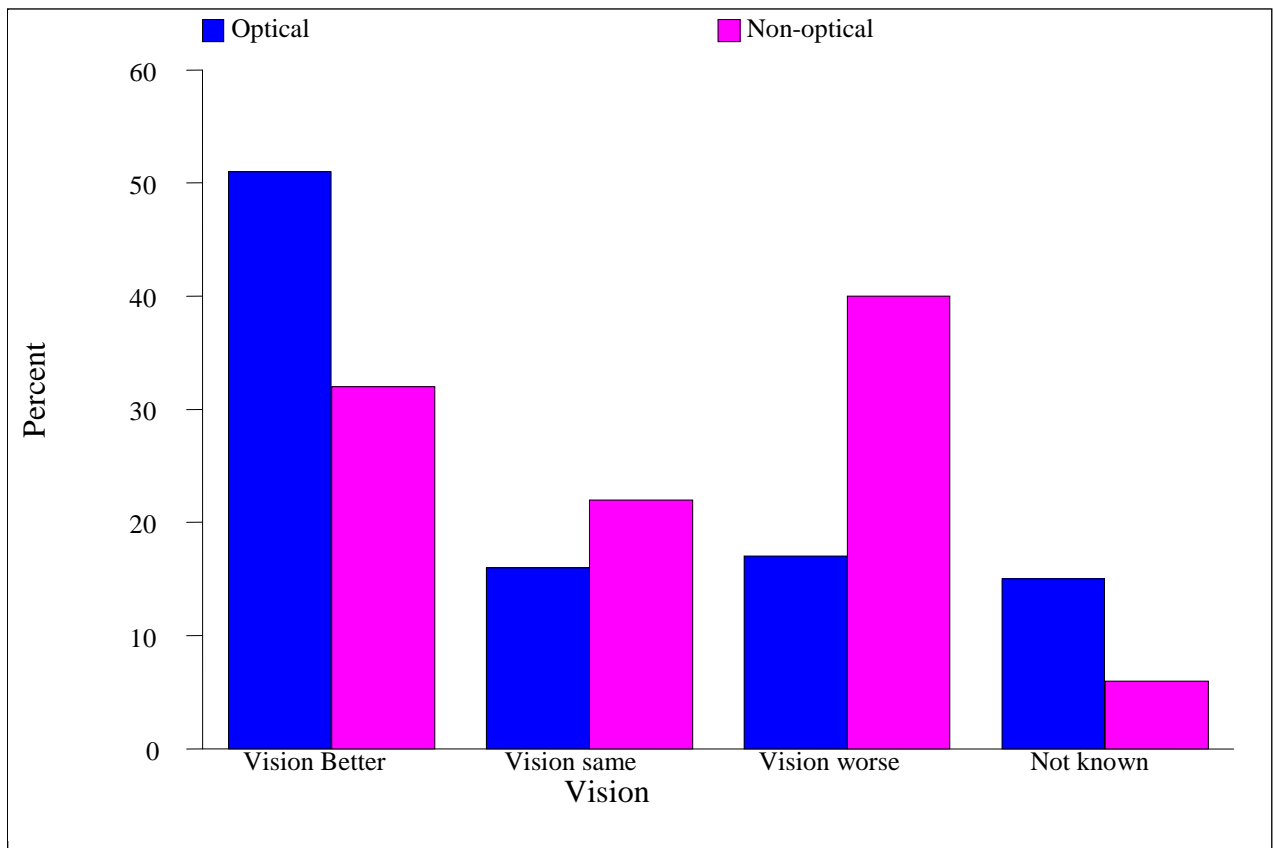


Figure 2.4.3.2: Unaided Visual Outcome After Corneal Transplant Surgery

Table 2.4.3.3: Unaided Vision for Optical and Non Optical Cases

Vision	Optical				Non Optical			
	Graft Survival (313)		Graft Failure (79)		Graft Survival (165)		Graft Failure (84)	
	No.	%	No.	%	No.	%	No.	%
6/18 or Better	92	29	0	0	27	16	2	2
6/24 – 6/60	111	36	3	4	36	22	3	4
Less than 6/60	85	27	74	94	38	23	76	90
Data not available	25	8	2	2	64	39	3	4

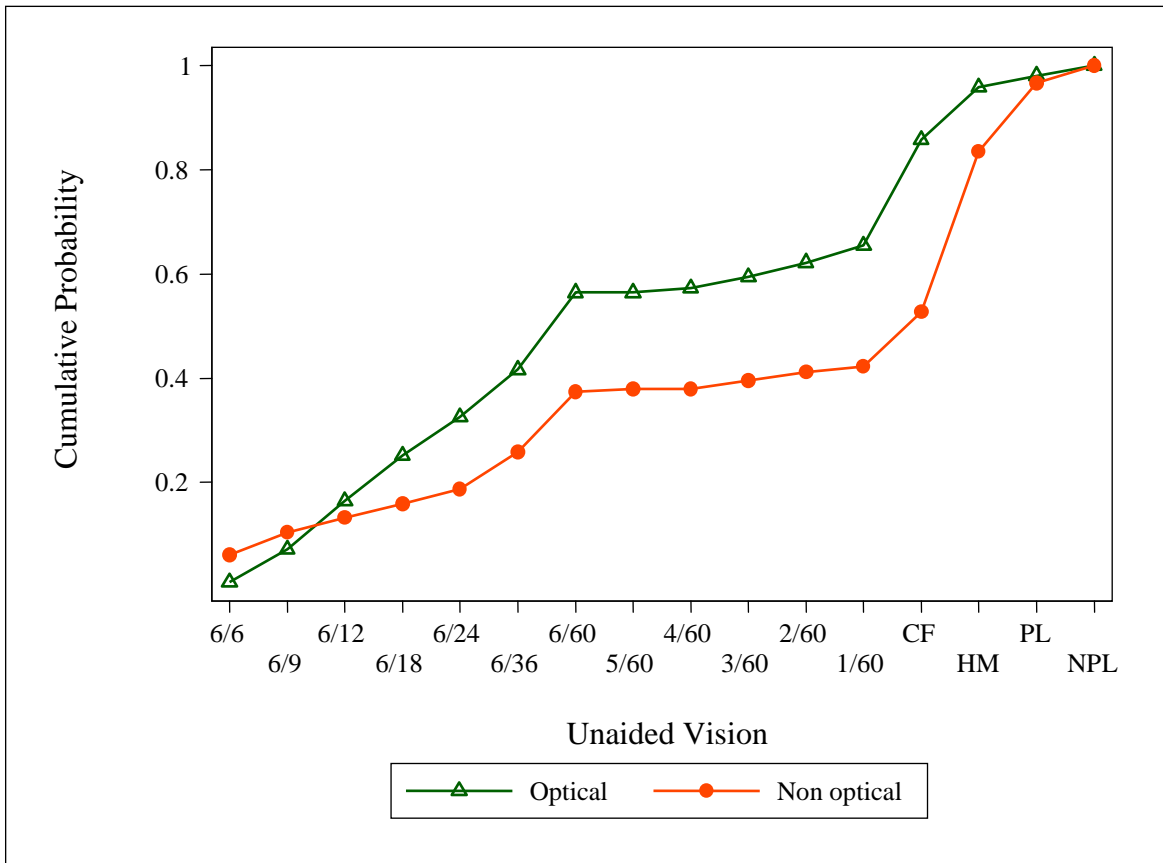


Figure 2.4.3.3: Cumulative Probability for Unaided Vision in Grafts

2.5 POST CORNEA TRANSPLANT COMPLICATIONS

Table 2.5.1: Post Transplant Complications

		One year outcome (N=395)		2 nd year outcome (N=114)		3 rd year outcome (N=54)		4 th year outcome (N=62)		Total (N=625)	
		No.	%	No.	%	No.	%	No.	%	No.	%
No complication		117	30	40	35	37	69	30	48	224	36
Any complications		129	110	17	43	8	22	16	53	170	76
Complication	Epithelial Problem	32	27	3	8	2	5	3	10	40	18
	Wound Dehiscence	3	3	0	0	0	0	0	0	3	1
	Suture infiltration / abscess	20	17	0	0	1	3	2	7	23	10
	Endophthalmitis	0	0	0	0	0	0	1	3	1	0
	Microbial keratitis	25	21	3	8	0	0	1	3	29	13
	Vascularisation	46	39	9	23	4	11	4	13	63	28
	Post-keratoplasty glaucoma	51	44	8	20	5	14	9	30	73	33
	Graft Rejection	55	13.9	6	5.3	6	11	3	4.8	70	11.2
No data		149	127	57	143	9	24	16	53	231	103

* Each patient may have more than one complication

Table 2.5.2: Post Transplant Graft Rejection Types

		One year outcome (N=395)		2 nd year outcome (N=114)		3 rd year outcome (N=54)		4 th year outcome (N=62)		Total (N=625)	
		No.	%	No.	%	No.	%	No.	%	No.	%
Graft Rejection		55	13.9	6	5.3	6	11	3	4.8	70	11.2
Types	Epithelial	13	24	2	33	1	17	1	33	17	24
	Stromal	13	24	2	33	0	0	0	0	15	21
	Endothelial	23	42	2	33	3	50	1	33	29	41
	No data	13	24	0	0	2	33	1	33	16	23

* Each patient may have more than one type of rejection