Australian Corneal Graft Registry Annual Report 2022

1 The Database

The Australian Corneal Graft Registry (ACGR) was established in 1985 and has now been in continuous operation for 37 years. The following document summarises the data contained in the Registry database on 30th June 2022. Only grafts performed up to 31st December 2021 had been entered by this date. Registrations for further grafts performed prior to 2022 are likely to still be added to the database in the future.

The database contains the following types of graft. The date range given for each graft type shows the years these have been registered with the ACGR.

- Penetrating Keratoplasty (PK): 1985 to 2021.
- Descemet's Stripping (Automated) Endothelial Keratoplasty (DS(A)EK): 2006* to 2021. *Encompassing both manual (from 2006) and automated (from 2008) versions of the technique, as well as an ultra-thin variant (from 2012).
- Descemet's Membrane Endothelial Keratoplasty (DMEK): 2007 to 2021.
- Deep Anterior Lamellar Keratoplasty (DALK): 2000 to 2021.
- Traditional/Tectonic Lamellar Keratoplasty (TLK): 1985 to 2021.
- Limbal/Stem Cell: 1987 to 2021.

Table 1 shows the breakdown of the database in terms of number of grafts registered, as well as the percentage of registered grafts with follow-up provided, known to have failed, and known to have failed from primary non-function. Primary non-function was defined as grafts that the surgeon reported did not clear in the immediate post-operative period. The cut-off time-point for these was 7 days for PK and 92 days (3-months) for lamellar grafts. In endothelial grafts this is often linked to graft detachment.

Table 1 Overview of the Australian Corneal Graft Registry database at 30th June 2022

	Registered	Followed	Failed	Primary non-function
PK	27475	83%	26%	<1%
DS(A)EK	7481	75%	23%	7%
DMEK	3884	62%	18%	14%
DALK	2145	62%	8%	2%
TLK	1719	74%	22%	1%
Limbal	92	72%	34%	1%
Total	**42796**	**78%**	**23%**	**3%**

Note: Percentage failed includes primary non-functioning grafts

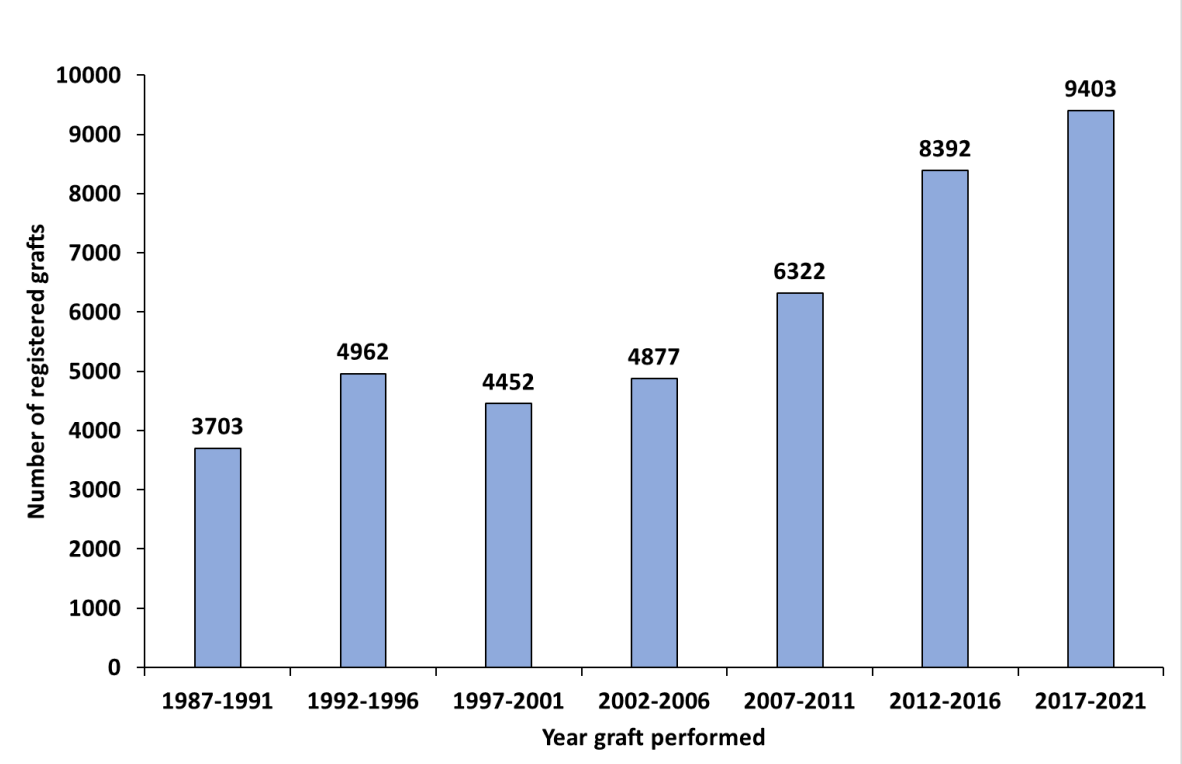
An annual follow-up request is sent to contributing surgeons in September. In some instances, the ACGR may be informed that the graft recipient is known to have died, or has been "lost to follow-up", i.e., is no longer seen by the surgeon, with no forwarding address available. Grafts will also be lost to follow-up after five-years without follow-up data provision but can be reactivated if the recipient is subsequently seen, e.g. for a contralateral or repeat graft. Linkage with the National Death Index is undertaken, where consent has been granted, to finalise records for deceased recipients. This is performed no more than once every 5 years, with the most recent linkage prior to the census date for this report completed in 2014. Table 2 shows the status of registered grafts in the database, including the number of each graft type for which follow-up information is still actively sort.

Table 2 Status of grafts in the Australian Corneal Graft Registry database at 30th June 2022

	PK	DS(A)EK	DMEK	DALK	TLK	Limbal	Total
Registered grafts	27475	7481	3884	2145	1719	92	42796
Failed graft	26%	23%	18%	8%	22%	34%	23%
Lost without follow-up received	8%	7%	7%	19%	11%	14%	9%
Lost post follow-up	28%	17%	8%	29%	29%	22%	24%
Died without follow-up received	4%	1%	0%	0%	6%	3%	3%
Died with surviving followed graft	15%	4%	1%	1%	13%	10%	11%
Active in database	**19%**	**49%**	**66%**	**43%**	**19%**	**17%**	**30%**

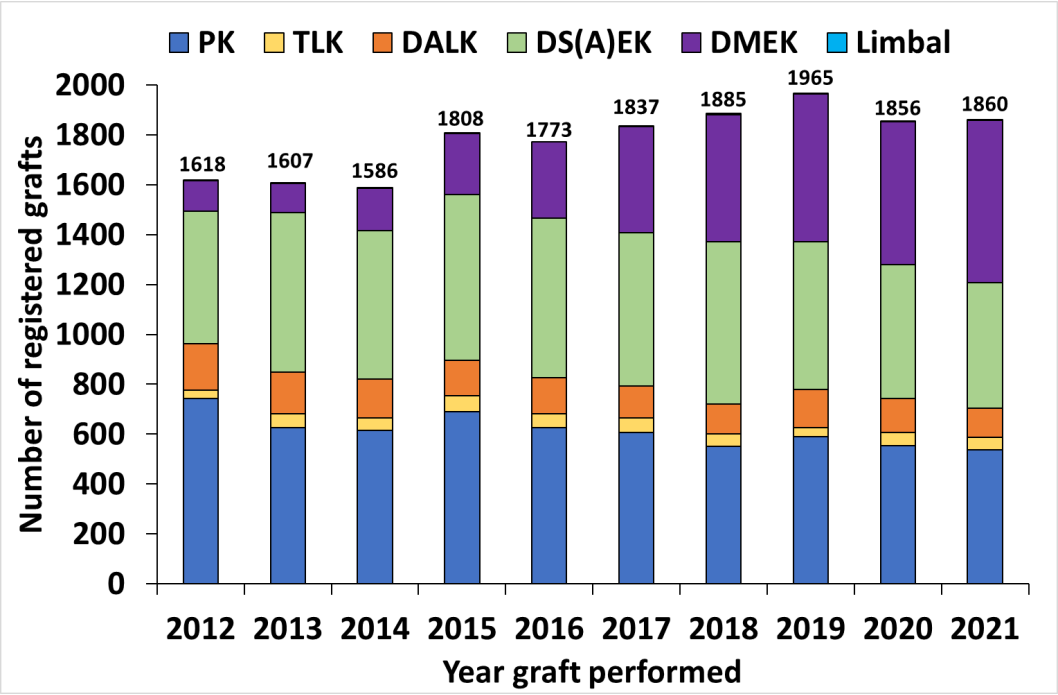
Following the introduction of the new varieties of partial thickness endothelial grafts from 2006 onwards, there was a steady increase in the number of grafts registered annually, as shown in Figure 1.

Figure 1 Number of grafts registered with the ACGR stratified by graft era, 1987 to 2021



The annual number of registrations has been stable over the last five years (Figure 2), though the impact of restrictions placed on elective surgery due to COVID-19 may have influenced these figures. There has been a shift in the type of grafts being registered with the ACGR (Figure 2 and Table 3), with fewer PK registrations coinciding with continued increases in registrations of DS(A)EK and then DMEK. In 2019 the number of registrations of each of these three graft types was almost equal. DMEK became the most frequently registered graft type in 2020 and retained this spot in 2021. This appears to be due to a continued shift away from DS(A)EK, rather than any ongoing drop in PKs, which appear to have stabilised to make up approximately 30% of grafts.

Figure 2 Number of grafts registered annually with the ACGR, by graft type, 2012 to 2021



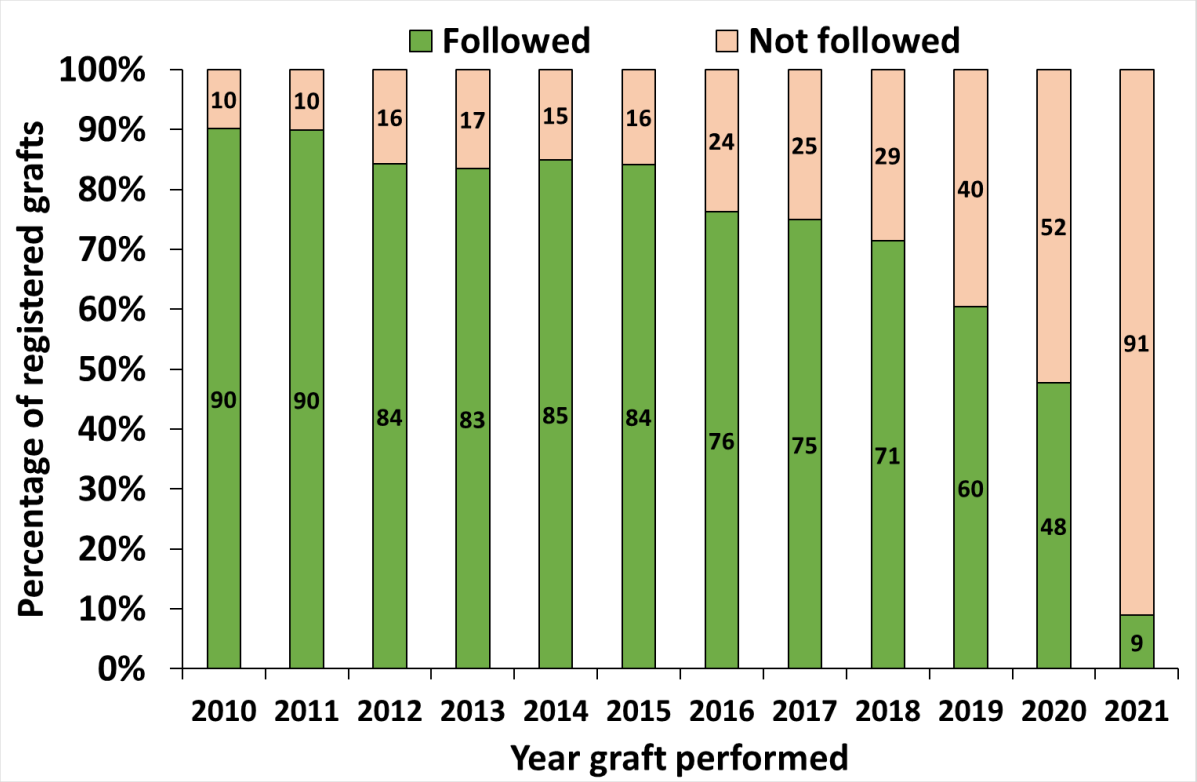
Note: grafts performed overseas using Australian corneal donor tissue are excluded.

Table 3 Percentage of grafts registered annually with the ACGR, by graft type, 2012 to 2021

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
PK	46%	39%	39%	38%	35%	33%	29%	30%	30%	29%
TLK	2%	3%	3%	3%	3%	3%	3%	2%	3%	3%
DALK	11%	10%	10%	8%	8%	7%	6%	8%	7%	6%
DS(A)EK	33%	40%	37%	37%	36%	34%	34%	30%	29%	27%
DMEK	8%	7%	11%	13%	17%	23%	27%	30%	31%	35%
Limbal	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%
Total	**1618**	**1607**	**1586**	**1808**	**1773**	**1837**	**1885**	**1965**	**1856**	**1860**

The ACGR requests follow-up in September. The first follow-up request will occur the year following the graft, so between 9 and 21 months after it is performed. Because of the delay in time to first follow-up, the percentage of grafts with follow-up is lowest the more recently the graft was performed, as shown in Figure 3. Most grafts with follow-up in the first year post-graft will be failed grafts where the eye has been regrafted and therefore the failure of the prior graft is known to the Registry. Follow-up reaches 70% approximately 4 years post-graft, 80% at 7 years post-graft, and 90% at 11 years post-graft. As shown in Table 2, small proportions of recipients are also known to die prior to follow-up information being received.

Figure 3 Percentage of grafts with follow-up provided to the ACGR stratified by year of graft



2 Indication for Graft

The four most common indications for graft recorded in the database are failed previous graft (25%), keratoconus (23%), endothelial failure/bullous keratopathy (18%), and Fuchs' endothelial dystrophy (18%). These account for 84% of all grafts. Indication for graft varies depending on the type of graft, as does the likelihood that the graft is a repeat procedure. Table 4 shows the proportion of grafts that are repeat procedures. The top three indications for each type of graft excluding repeat procedures, are highlighted, showing the variation across groups.

Table 4 Indication for graft, 1985 to 2021, stratified by type of graft

	PK	TLK	DALK	DS(A)EK	DMEK	Total
Failed previous graft	28%	15%	4%	24%	22%	25%
Keratoconus	**30%**	6%	**75%**	0%	0%	23%
Endothelial failure/bullous keratopathy	**17%**	<1%	0%	**30%**	**15%**	18%
Fuchs' Endothelial Dystrophy	**8%**	0%	0%	**44%**	**61%**	18%
Herpetic eye disease	5%	5%	**4%**	<1%	0%	3%
Corneal ulcers	2%	**12%**	1%	<1%	0%	2%
Trauma	3%	2%	1%	**1%**	**1%**	2%
Corneal degenerations	<1%	4%	**4%**	<1%	<1%	<1%
Beta-Radiation	<1%	**15%**	<1%	0%	0%	<1%
Pterygium	<1%	**13%**	0%	0%	0%	<1%
Other	7%	27%	11%	<1%	<1%	6%
Total	27475	1719	2145	7481	3884	42704

Note: Limbal grafts not included

Table 5 shows the same data but confined to the 10-year period from 2012 to 2021. Fuchs' endothelial dystrophy is now the second most common indication for graft behind repeat procedures.

Table 5 Indication for graft, 2012 to 2021, stratified by type of graft

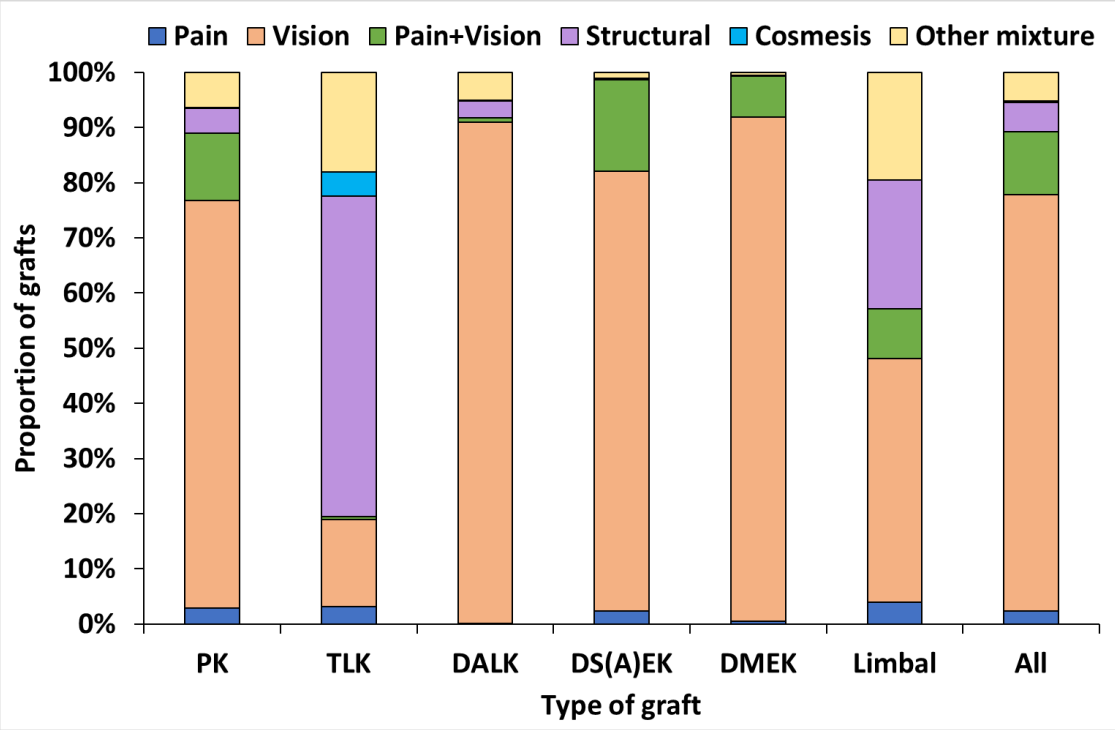
	PK	TLK	DALK	DS(A)EK	DMEK	Total
Failed previous graft	47%	15%	5%	25%	22%	30%
Keratoconus	**25%**	3%	**74%**	0%	0%	15%
Endothelial failure/bullous keratopathy	**5%**	<1%	0%	**30%**	**15%**	15%
Fuchs' Endothelial Dystrophy	2%	0%	0%	**43%**	**62%**	28%
Herpetic eye disease	**5%**	6%	**4%**	<1%	0%	2%
Corneal ulcers	3%	**19%**	2%	<1%	0%	2%
Trauma	3%	2%	1%	**2%**	**1%**	2%
Corneal degenerations	1%	6%	**4%**	<1%	0%	<1%
Beta-Radiation	0%	**11%**	<1%	0%	0%	<1%
Glaucoma	0%	**11%**	<1%	0%	0%	<1%
Other	8%	29%	11%	<1%	<1%	5%
Total	6136	506	1453	5969	3711	17775

Note: Limbal grafts not included

3 Reason for Graft

Surgeons are asked to report the reason a patient has undergone corneal transplantation. They can select any applicable answers from the following options: relief of pain, visual rehabilitation, structural repair, cosmesis. The reason for graft has been provided for 88% of grafts. The most common reason for graft is visual rehabilitation, with this selected in over 90% of grafts for which these data have been provided. In one-sixth of cases this is in conjunction with another reason, most often pain relief. The reason for graft varies depending on type of graft, as shown in Figure 4.

Figure 4 Reason for graft, 1985 to 2021, stratified by type of graft



Reason for graft was only provided for 60% of grafts performed prior to 1997. By the late 90s, 95% of grafts were having this information provided at registration (Table 6). The proportion performed solely for visual rehabilitation has increased, to over three-quarters of grafts performed from 2017 to 2021. In contrast, the proportion performed for pain, either individually or in conjunction with other reasons, has halved, from 20% to less than 10%.

Table 6 Reason for graft, 1987 to 2021, stratified by era of graft

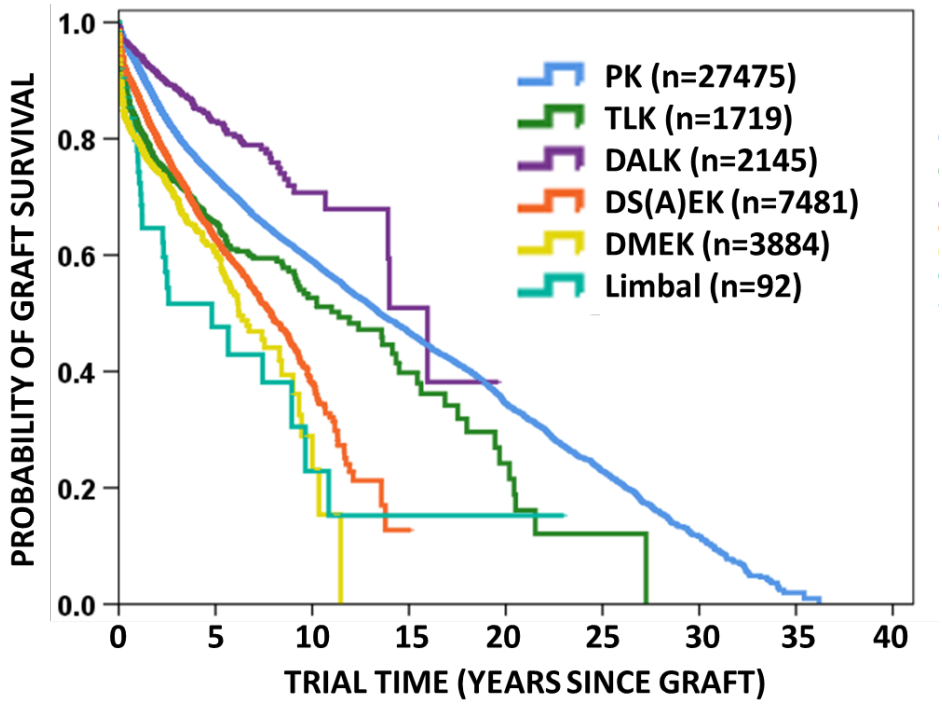
	Vision	Vision + Pain	Pain	Structural	Cosmesis	Other Mix**	Not specified	Total
1997-2001	64%	15%	3%	6%	<1%	6%	5%	4452
2002-2006	68%	15%	2%	6%	<1%	6%	3%	4877
2007-2011	72%	12%	2%	5%	<1%	5%	5%	6322
2012-2016	75%	10%	1%	5%	<1%	5%	4%	8392
2017-2021	76%	7%	1%	4%	<1%	4%	7%	9403
All grafts*	66%	10%	2%	5%	<1%	5%	12%	42796

*Includes registered grafts performed from 1985 to 1996. **May also include pain and/or vision.

4 Graft Survival

Surgeons report follow-up to the date they last saw the patient, rather than standardised time-points (e.g. 12 months) and survival is calculated in terms of days since graft. Grafts for which follow-up information has not yet been received are assumed to be surviving at one day post-graft and are treated as such in analyses. The survival of registered grafts is assessed using Kaplan-Meier survival curves. The number at risk tables show how many grafts are followed in each group, at each time point. The survival probability tables extend to the point where a minimum of 20 grafts have follow-up data available. Survival of all grafts stratified by type of graft, is shown in Figure 5.

Figure 5 Survival of all grafts registered from 1985 to 2021, stratified by type of graft

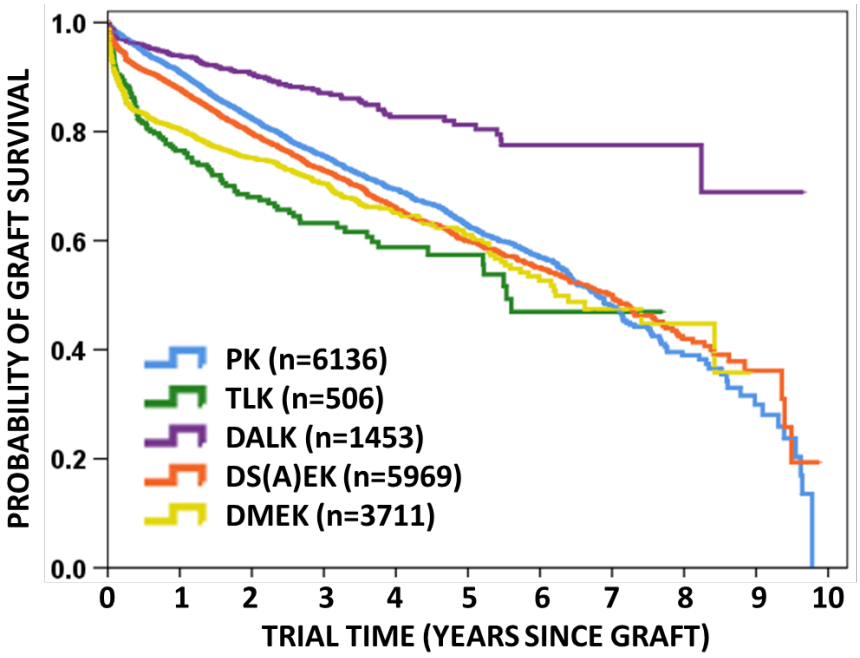


Number at risk	1 Year	2 Years	5 Years	10 Years	15 Years	20 Years	25 Years	30 Years
PK	18996	14423	7701	3385	1656	813	366	98
TLK	794	559	251	71	24	9	1	NA
DALK	1139	790	259	38	4	NA	NA	NA
DS(A)EK	4121	3064	1122	110	1	NA	NA	NA
DMEK	1484	874	155	5	NA	NA	NA	NA
Limbal	41	28	12	3	2	2	NA	NA

Survival probability	1 Year	2 Years	5 Years	10 Years	15 Years	20 Years	25 Years	30 Years
PK	0.93	0.86	0.76	0.59	0.47	0.35	0.23	0.12
TLK	0.82	0.76	0.66	0.53	0.40	NA	NA	NA
DALK	0.95	0.91	0.83	0.71	NA	NA	NA	NA
DS(A)EK	0.87	0.80	0.63	0.38	NA	NA	NA	NA
DMEK	0.80	0.75	0.61	NA	NA	NA	NA	NA
Limbal	0.76	0.65	NA	NA	NA	NA	NA	NA

As shown earlier in Figure 3, the different era in which each type of graft has been performed affects the likelihood that follow-up information will have been received. Figure 6 and the associated tables show the survival of grafts performed in the ten-year period from 2012 to 2021, stratified by type of graft. Limbal grafts are excluded from this analysis as fewer than 20 performed during this time period had follow-up data available.

Figure 6 Survival of all grafts registered from 2012 to 2021, stratified by type of graft

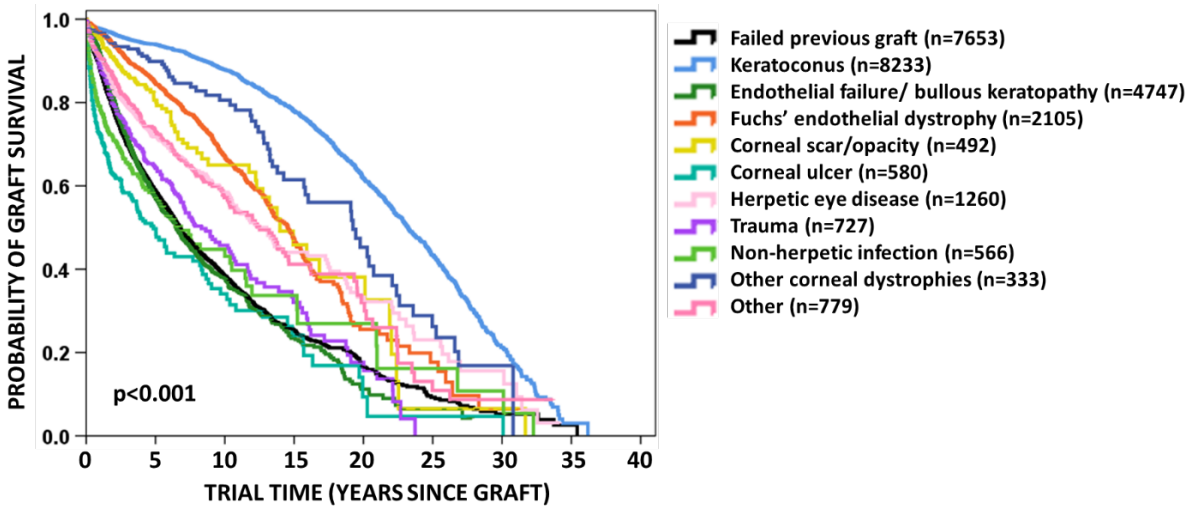


Number at risk	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	7 Years	8 Years
PK	3419	2294	1546	1012	610	363	163	63
TLK	187	124	86	57	35	14	6	NA
DALK	668	465	291	171	100	58	30	12
DS(A)EK	3066	2190	1442	928	595	358	191	77
DMEK	1410	835	459	235	135	67	25	11

Survival probability	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	7 Years	8 Years
PK	0.91	0.83	0.76	0.69	0.63	0.57	0.48	0.39
TLK	0.77	0.68	0.63	0.59	0.57	NA	NA	NA
DALK	0.94	0.91	0.87	0.83	0.81	0.78	0.78	NA
DS(A)EK	0.88	0.80	0.73	0.66	0.60	0.55	0.50	0.42
DMEK	0.81	0.75	0.70	0.65	0.61	0.53	0.47	NA

One of the major factors affecting graft survival has consistently been found to be indication for graft. The following analyses show the survival for each individual type of graft, stratified by the indications for graft, for each type of graft.

Figure 7 Survival of PKs performed from 1985 to 2021, stratified by indication for graft

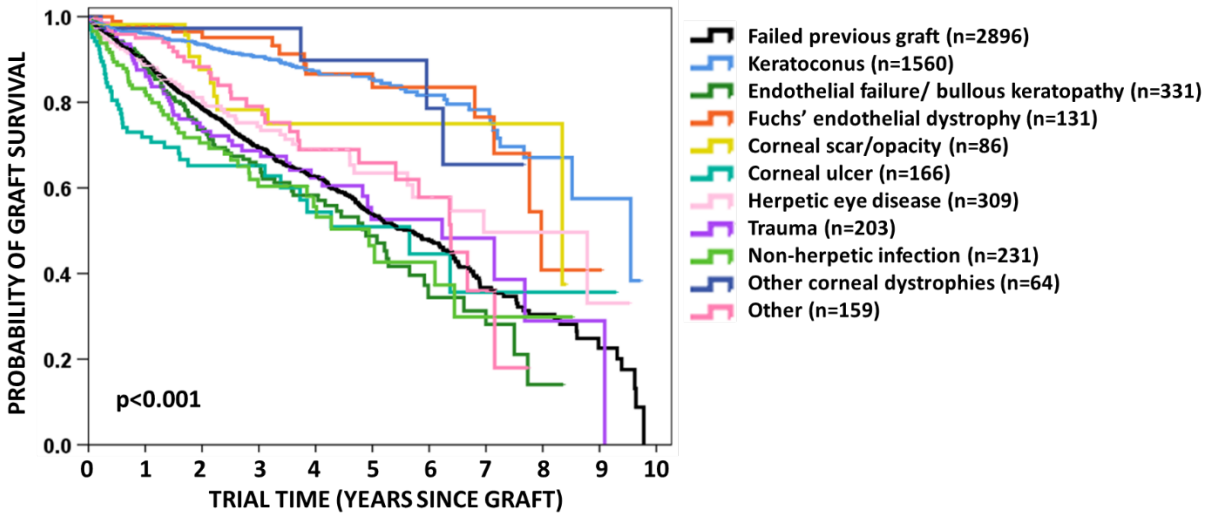


Number at risk	1 Year	2 Years	5 Years	10 Years	15 Years	20 Years	25 Years	30 Years
Failed previous graft	4934	3652	1742	586	213	89	28	7
Keratoconus	6206	4914	2965	1669	1040	587	291	79
Endothelial failure/BK	3174	2201	899	254	77	18	5	NA
Fuchs' endothelial dystrophy	1693	1439	940	418	129	28	8	1
Corneal scar/opacity	327	235	124	40	14	7	1	1
Corneal ulcer	254	170	75	27	11	2	1	1
Herpetic eye disease	866	635	325	135	60	30	14	5
Trauma	479	354	174	60	25	9	NA	NA
Non-herpetic infection	275	196	89	27	10	5	3	2
Other corneal dystrophies	247	214	136	68	35	21	10	1
Other	541	413	233	102	42	17	5	1

Survival probability	1 Year	2 Years	5 Years	10 Years	15 Years	20 Years	25 Years	30 Years
Failed previous graft	0.89	0.78	0.59	0.38	0.25	0.17	0.09	NA
Keratoconus	0.98	0.97	0.94	0.88	0.78	0.62	0.43	0.21
Endothelial failure/BK	0.91	0.81	0.57	0.38	0.24	NA	NA	NA
Fuchs' endothelial dystrophy	0.97	0.94	0.85	0.67	0.47	0.26	NA	NA
Corneal scar/opacity	0.95	0.91	0.81	0.65	NA	NA	NA	NA
Corneal ulcer	0.73	0.63	0.50	0.34	NA	NA	NA	NA
Herpetic eye disease	0.90	0.83	0.72	0.59	0.44	0.33	NA	NA
Trauma	0.89	0.80	0.64	0.46	0.32	NA	NA	NA
Non-herpetic infection	0.79	0.71	0.58	0.45	NA	NA	NA	NA
Other corneal dystrophies	0.97	0.94	0.90	0.81	0.62	0.45	NA	NA
Other	0.91	0.86	0.73	0.57	0.41	NA	NA	NA

As shown in tables 4 and 5, the indications reported for PKs have changed in recent years. Figure 8, and its related tables, present the results for PK performed from 2012 to 2021.

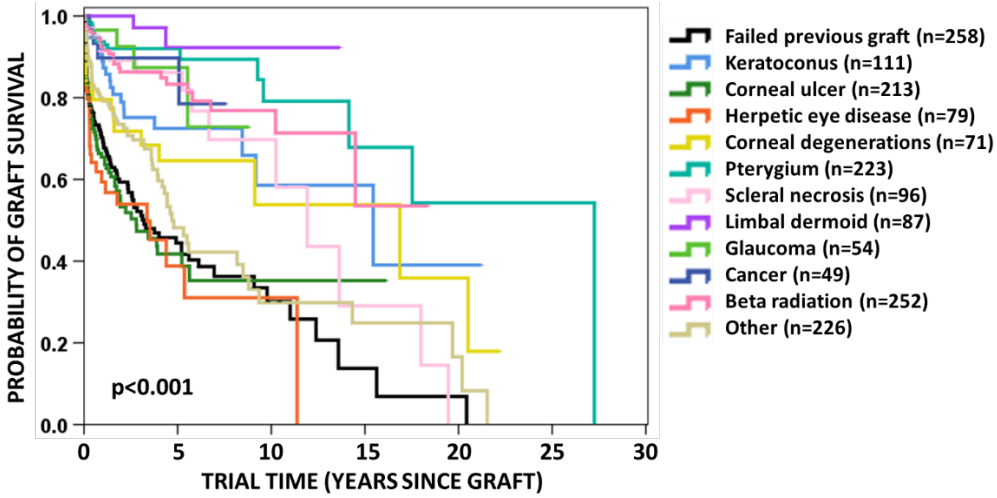
Figure 8 Survival of PKs performed from 2012 to 2021, stratified by indication for graft



Number at risk	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	7 Years	8 Years
Failed previous graft	1560	1043	699	470	282	164	63	32
Keratoconus	936	635	417	270	160	91	49	17
Endothelial failure/BK	200	127	85	53	29	12	10	1
Fuchs' endothelial dystrophy	85	70	54	35	28	19	11	3
Corneal scar/opacity	49	29	25	18	12	7	4	2
Corneal ulcer	62	41	28	19	12	7	3	1
Herpetic eye disease	175	121	83	49	29	20	9	3
Trauma	115	76	53	34	19	14	5	2
Non-herpetic infection	100	58	38	23	12	8	4	2
Other corneal dystrophies	35	29	21	11	8	7	3	NA
Other	102	65	43	27	19	12	2	NA

Survival probability	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	7 Years	8 Years
Failed previous graft	0.90	0.79	0.69	0.63	0.54	0.48	0.37	0.30
Keratoconus	0.96	0.94	0.91	0.87	0.86	0.82	0.78	NA
Endothelial failure/BK	0.88	0.74	0.65	0.58	0.49	NA	NA	NA
Fuchs' endothelial dystrophy	0.98	0.97	0.95	0.87	0.87	NA	NA	NA
Corneal scar/opacity	0.98	0.88	0.78	NA	NA	NA	NA	NA
Corneal ulcer	0.72	0.65	0.65	NA	NA	NA	NA	NA
Herpetic eye disease	0.89	0.81	0.74	0.69	0.64	0.58	NA	NA
Trauma	0.88	0.74	0.69	0.62	NA	NA	NA	NA
Non-herpetic infection	0.82	0.71	0.60	0.56	NA	NA	NA	NA
Other corneal dystrophies	0.97	0.97	0.97	NA	NA	NA	NA	NA
Other	0.95	0.88	0.71	0.69	NA	NA	NA	NA

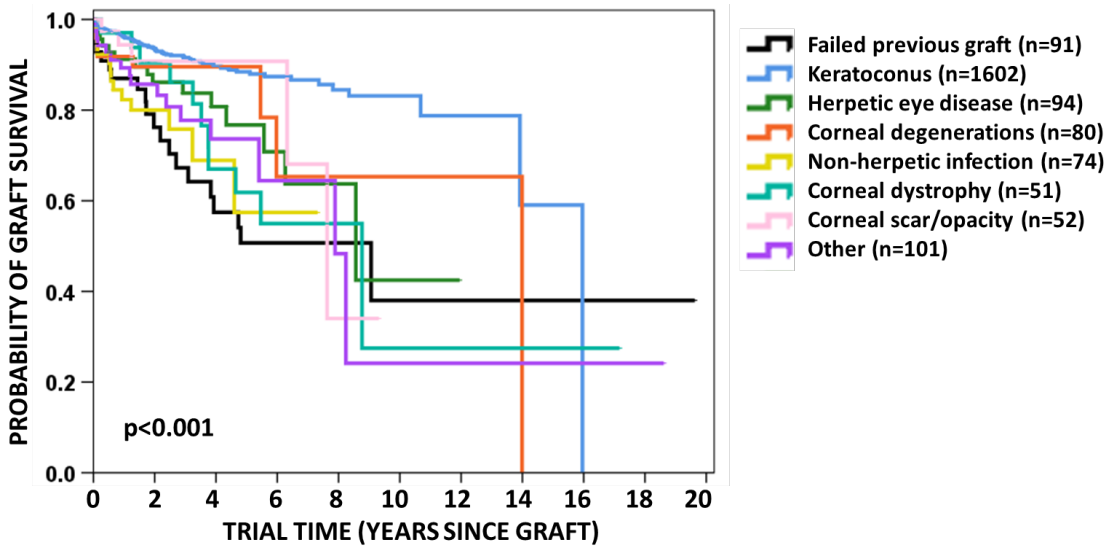
Figure 9 Survival of TLKs performed from 1985 to 2021, stratified by indication for graft



Number at risk	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	7 Years	8 Years
Failed previous graft	109	75	52	41	34	26	15	13
Keratoconus	58	42	33	24	20	18	15	11
Corneal ulcer	71	40	27	22	15	8	8	6
Herpetic eye disease	24	18	13	8	5	3	3	3
Corneal degeneration	37	23	21	18	13	9	9	8
Pterygium	120	81	63	46	37	31	27	23
Scleral necrosis	43	34	28	25	22	13	8	6
Limbal dermoid	53	39	32	24	18	14	9	6
Glaucoma	25	22	11	8	7	3	1	1
Cancer	22	15	10	8	8	4	1	NA
Beta radiation	125	87	74	62	44	36	32	26
Other	107	83	65	42	28	18	16	14

Survival probability	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	7 Years	8 Years
Failed previous graft	0.70	0.59	0.52	0.47	0.45	0.40	NA	NA
Keratoconus	0.89	0.79	0.75	0.73	0.73	NA	NA	NA
Corneal ulcer	0.66	0.53	0.47	0.42	NA	NA	NA	NA
Herpetic eye disease	0.59	NA	NA	NA	NA	NA	NA	NA
Corneal degeneration	0.80	0.72	0.72	NA	NA	NA	NA	NA
Pterygium	0.94	0.92	0.92	0.92	0.92	0.89	0.89	0.89
Scleral necrosis	0.91	0.89	0.86	0.86	0.86	NA	NA	NA
Limbal dermoid	1.00	1.00	0.97	0.97	NA	NA	NA	NA
Glaucoma	0.97	0.93	NA	NA	NA	NA	NA	NA
Cancer	0.90	NA	NA	NA	NA	NA	NA	NA
Beta radiation	0.92	0.86	0.86	0.86	0.83	0.79	0.77	0.77
Other	0.79	0.74	0.70	0.60	0.48	NA	NA	NA

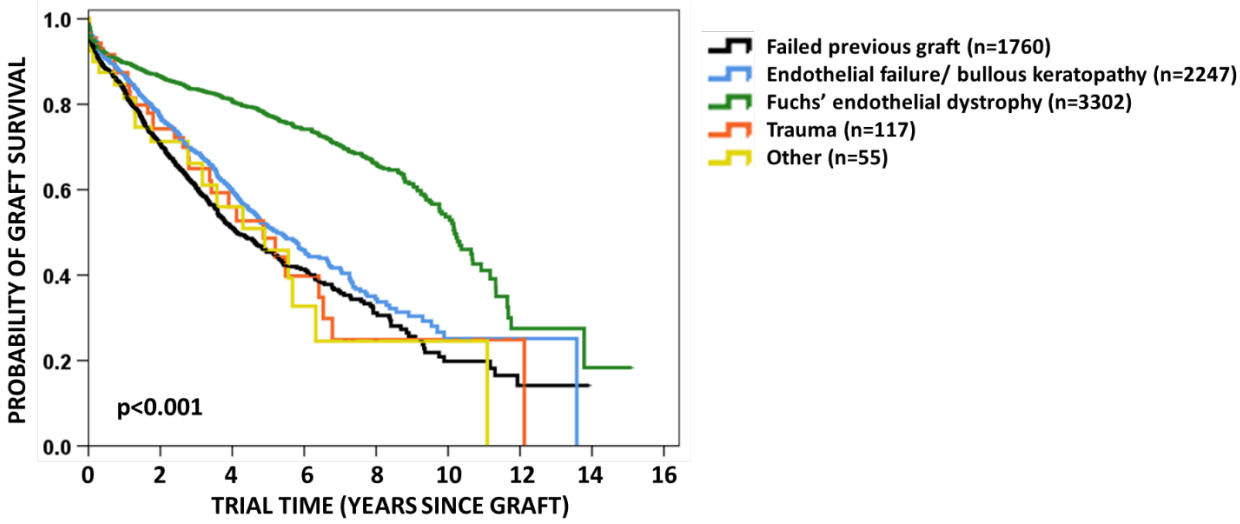
Figure 10 Survival of DALKs performed from 2000 to 2021, stratified by indication for graft



Number at risk	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	7 Years	8 Years	9 Years	10 Years
Failed previous graft	41	26	22	17	15	11	8	7	4	3
Keratoconus	847	579	389	265	185	136	103	68	48	29
Herpetic eye disease	58	50	33	26	17	12	9	4	2	1
Corneal degenerations	42	30	24	14	8	5	5	5	4	3
Non-herpetic infection	38	25	12	8	5	3	1	NA	NA	NA
Corneal dystrophy	31	23	18	13	11	7	4	2	1	1
Corneal scar/opacity	30	22	15	11	8	6	2	1	1	NA
Other	52	35	26	17	10	6	5	3	1	1

Survival probability	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	7 Years	8 Years	9 Years	10 Years
Failed previous graft	0.87	0.76	0.67	NA	NA	NA	NA	NA	NA	NA
Keratoconus	0.96	0.94	0.92	0.90	0.89	0.87	0.87	0.85	0.83	0.83
Herpetic eye disease	0.91	0.86	0.84	0.81	NA	NA	NA	NA	NA	NA
Corneal degenerations	0.92	0.90	0.90	NA	NA	NA	NA	NA	NA	NA
Non-herpetic infection	0.82	0.80	NA	NA	NA	NA	NA	NA	NA	NA
Corneal dystrophy	0.97	0.91	NA	NA	NA	NA	NA	NA	NA	NA
Corneal scar/opacity	0.94	0.91	NA	NA	NA	NA	NA	NA	NA	NA
Other	0.89	0.86	0.78	NA	NA	NA	NA	NA	NA	NA

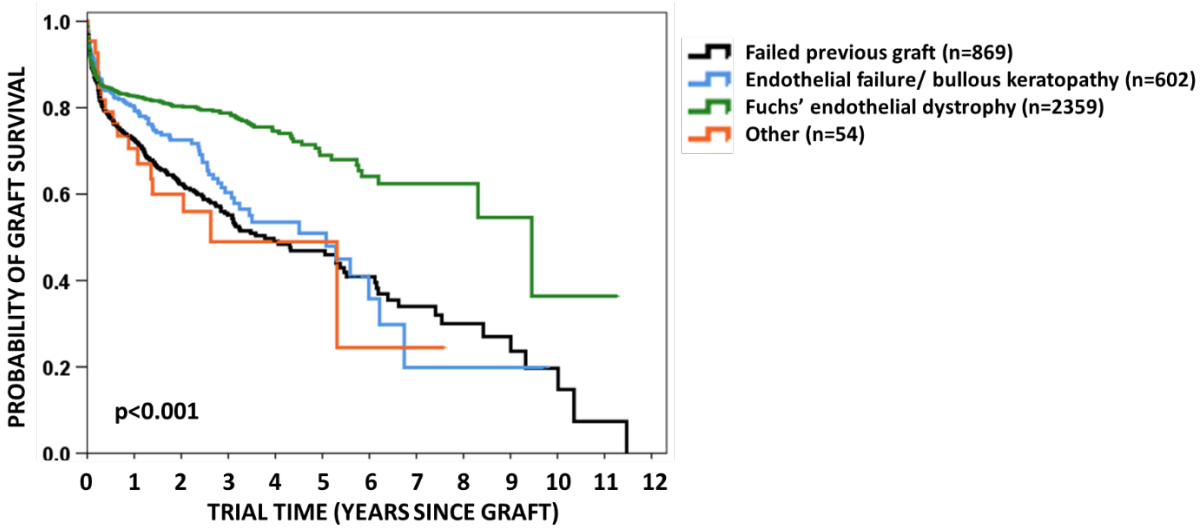
Figure 11 Survival of DS(A)EKs performed from 2006 to 2021, stratified by indication for graft



Number at risk	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	7 Years	8 Years	9 Years	10 Years	11 Years
Failed previous graft	889	601	410	265	187	126	82	55	29	17	12
Endothelial failure/BK	1136	788	514	336	221	149	100	51	29	14	6
Fuchs' endothelial dystrophy	2010	1616	1215	917	693	499	361	250	154	76	24
Trauma	60	39	25	17	12	8	5	3	2	2	2
Other	26	20	13	11	9	5	2	2	1	1	1

Survival probability	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	7 Years	8 Years	9 Years	10 Years	11 Years
Failed previous graft	0.83	0.71	0.60	0.51	0.45	0.41	0.36	0.31	0.26	NA	NA
Endothelial failure/BK	0.87	0.77	0.69	0.60	0.51	0.46	0.42	0.34	0.30	NA	NA
Fuchs' endothelial dystrophy	0.90	0.87	0.84	0.81	0.78	0.74	0.70	0.66	0.61	0.54	0.41
Trauma	0.87	0.74	0.65	NA	NA	NA	NA	NA	NA	NA	NA
Other	0.82	0.71	NA	NA	NA	NA	NA	NA	NA	NA	NA

Figure 12 Survival of DMEKs performed from 2007 to 2021, stratified by indication for graft



Number at risk	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	7 Years
Failed previous graft	334	196	130	75	51	34	20
Endothelial failure/BK	203	112	51	29	19	7	2
Fuchs' endothelial dystrophy	927	551	299	152	83	44	18
Other	20	15	4	3	3	1	1

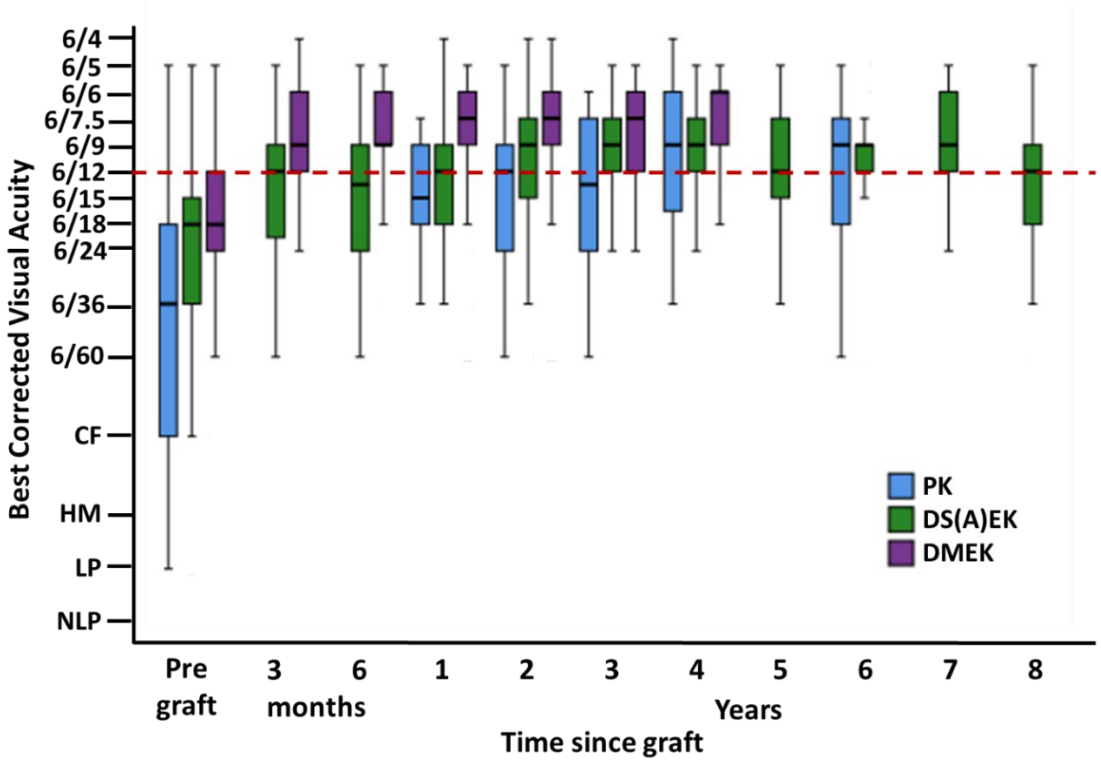
Survival probability	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	7 Years
Failed previous graft	0.73	0.62	0.55	0.49	0.47	0.41	0.34
Endothelial failure/BK	0.80	0.73	0.60	0.54	NA	NA	NA
Fuchs' endothelial dystrophy	0.83	0.80	0.79	0.75	0.69	0.64	NA
Other	0.71	NA	NA	NA	NA	NA	NA

5 Visual Acuity

The most commonly reported aim of corneal grafting is improvement in visual acuity. To be successful, a graft must therefore firstly survive, and then secondly provide a level of best corrected visual acuity (BCVA) that is adequate for the recipient's needs. Data from the ACGR chart the visual outcomes in grafts at various time points post-graft.

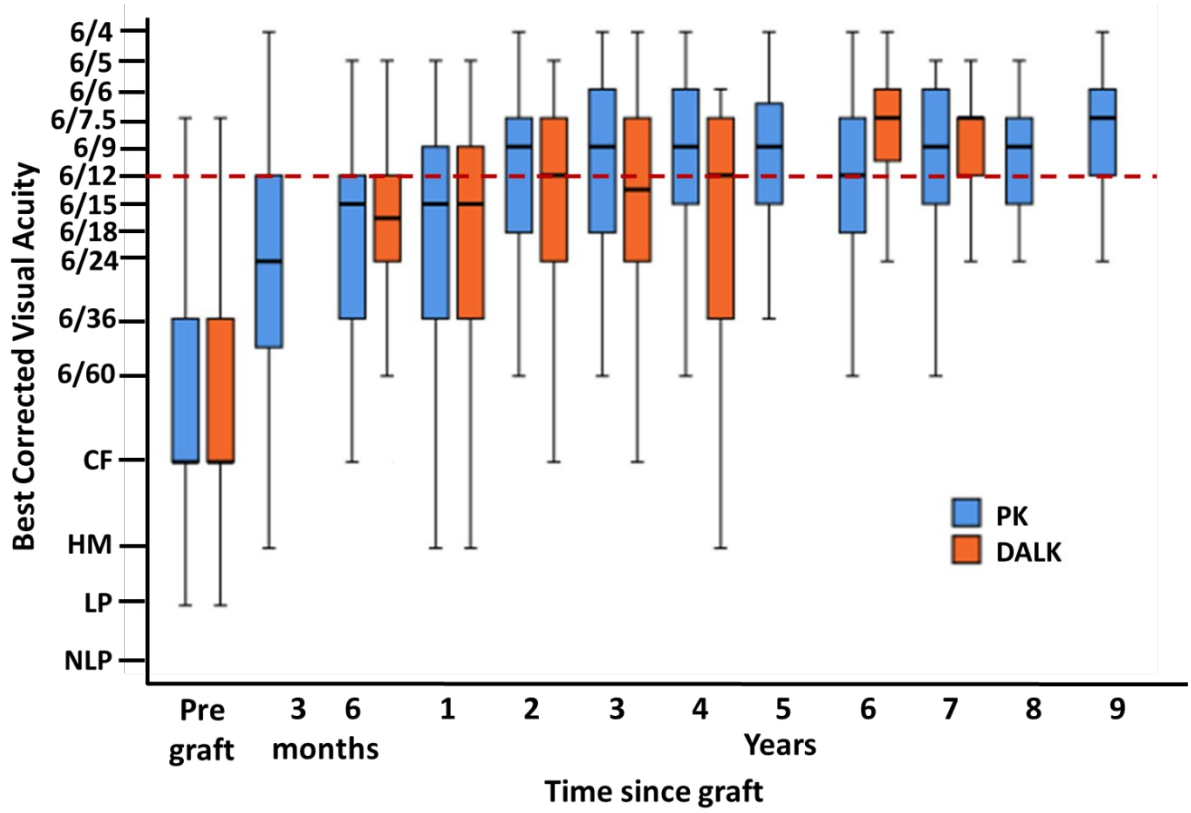
Figure 13 and Figure 14 show the BCVA in the grafted eye at various time points, for first grafts performed for Fuchs' endothelial dystrophy (FED) and keratoconus, respectively. These data are for grafts performed since 2007 and include data for surviving grafts at each time point. They are stratified by graft type, with box plots presented for groups with data available for 20 or more grafts. The box indicates the interquartile range (middle 50%) of values, with the central line showing the median value. Functional vision of 6/12 is indicated by the red dashed line. The accompanying tables indicate the number of grafts for which data were available at each time point, with analyses performed where at least 20 grafts had data provided. Improvements in BCVA were found in surviving grafts, for all graft types, for both indications for graft.

Figure 13 BCVA at various time points pre- and post-graft, in surviving grafts performed for Fuchs' endothelial dystrophy from 2007 to 2021, stratified by type of graft



	Pre graft	3 months	6 months	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	7 Years	8 Years
PK	445	7	6	25	51	20	20	13	22	19	14
DS(A)EK	3071	131	176	282	231	166	89	84	66	52	33
DMEK	2218	122	100	222	108	68	22	16	9	1	1

Figure 14 BCVA at various time points pre- and post-graft, in surviving grafts performed for keratoconus from 2007 to 2021, stratified by type of graft



	Pre graft	3 months	6 months	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	7 Years	8 Years	9 Years
PK	2529	44	35	250	201	120	82	80	49	42	20	29
DALK	1416	18	46	132	84	46	26	15	20	20	4	1

For FED, the pre-graft BCVA varies significantly across graft types, with DMEK performed in eyes with significantly better pre-graft vision than either PK or DS(A)EK, and DS(A)EK in eyes with better vision than PK. There were insufficient data to analyse the short-term 3- and 6-month outcomes for PK. The documented post-graft BCVA in DMEK is significantly better than that for both DS(A)EK and PK up to 4-years post-graft, and functional vision can be achieved within 3-months. The BCVA following DS(A)EK and PK did not differ significantly at most post-graft time points, however it was superior for DS(A)EK at 2-years post-graft (p=0.002). The lower number of PK being performed for this indication reduces the available data needed to enable analyses at the later time points.

Median post-graft BCVA achievement reached functional vision by 2-years post-graft for both PK and DALK performed for keratoconus. The post-graft BCVA did not differ significantly between groups except at 3-years, when superior vision was reported following PK compared to DALK (p=0.047).