Australian Corneal Graft Registry Annual Report 2024

1 The Database

The Australian Corneal Graft Registry (ACGR) was established in 1985 and has now been in continuous operation for 39 years. The following document summarises the data contained in the Registry database on 30th June 2024. Only grafts performed up to 31st December 2023 had been entered by this date. Registrations for further grafts performed prior to 2024 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 2023.
- Descemet's Stripping (Automated) Endothelial Keratoplasty (DS(A)EK): 2006* to 2023. *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 2023.
- Deep Anterior Lamellar Keratoplasty (DALK): 2000 to 2023.
- Traditional/Tectonic Lamellar Keratoplasty (TLK): 1985 to 2023.
- Corneal Allogenic Intrastromal Ring Segments (CAIRS): 2021 to 2023.
- Limbal/Stem Cell: 1987 to 2023.

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 was often linked to graft detachment.

Table 1 Overview of the Australian Corneal Graft Registry database at 30th June 2024

	Registered	Followed	Failed	Primary non-function
PK	28620	83%	27%	<1%
DS(A)EK	8673	77%	25%	5%
DMEK	5251	66%	18%	8%
DALK	2357	63%	9%	1%
TLK	1806	75%	22%	1%
Limbal	88	77%	39%	0%
CAIRS	81	4%	2%	0%
Total	**46876**	**79%**	**24%**	**2%**

Note: Percentage failed includes primary non-functioning grafts

In previous annual reports, CAIRS were included in the TLK category. Ongoing auditing of historical records may result in small changes of numbers in categories compared to prior reports as coding errors are detected and corrected, and duplicate records are removed.

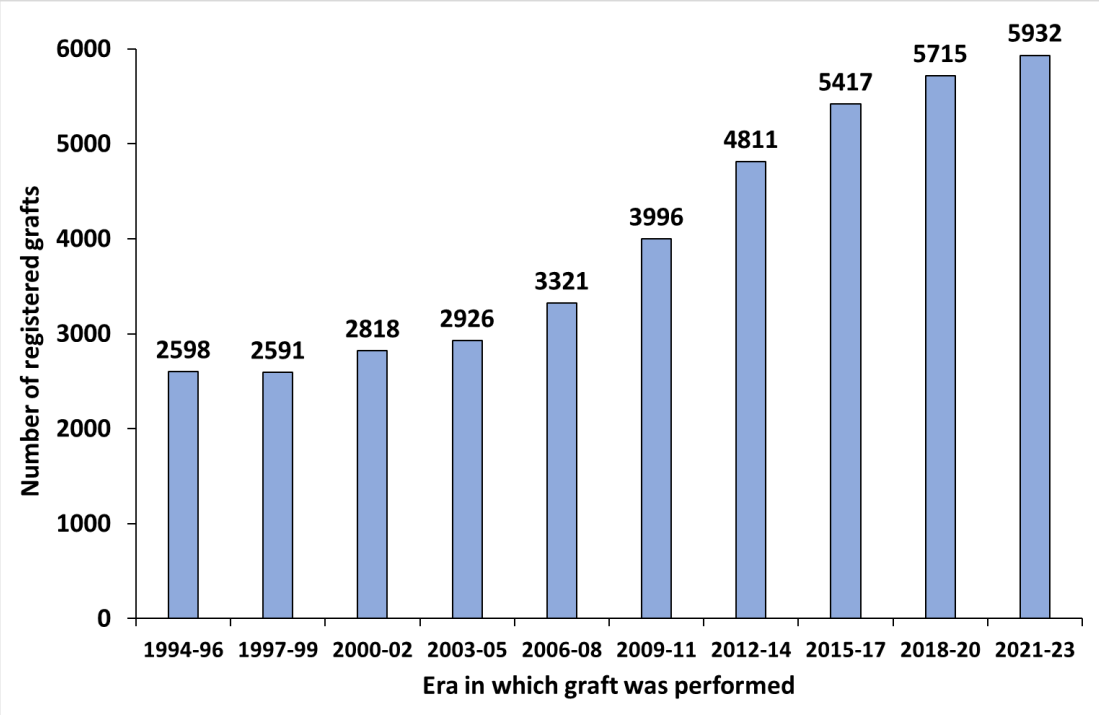
An annual follow-up request is sent to contributing surgeons in September. In some instances, the ACGR may be informed that the graft recipient is known to have died, or has been "lost to follow-up", i.e., is no longer seen by the surgeon. Grafts will also be lost to follow-up after five-years without 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 2022. 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 2024

	PK	DS(A)EK	DMEK	DALK	TLK	Limbal	CAIRS	Total
Registered grafts	28620	8673	5251	2357	1806	88	81	46876
Failed graft	27%	25%	18%	9%	22%	39%	2%	24%
Lost without follow-up received	7%	6%	7%	20%	9%	13%	0%	8%
Lost post follow-up	24%	12%	10%	29%	26%	22%	1%	21%
Died without follow-up received	5%	3%	2%	<1%	10%	5%	0%	4%
Died with surviving followed graft	20%	11%	4%	3%	19%	13%	0%	16%
Active in database	**17%**	**43%**	**59%**	**39%**	**15%**	**10%**	**96%**	**27%**

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, 1994 to 2023



The annual number of registrations was stable, with expected small levels of fluctuation, over the five years from 2018 to 2022 (Figure 2). The impact of restrictions placed on elective surgery due to COVID-19 may have influenced these figures. With these restrictions lifted, 2023 saw an increase of approximately 180 registrations compared to these levels. 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 through to 2023. After small drops in the number of PK and DMEK registered in 2022, compared to 2021, these figures bounced back, and increased slightly, in 2023. The proportion of grafts that are PK continues to reduce.

Figure 2 Number of grafts registered annually with the ACGR, by graft type, 2014 to 2023

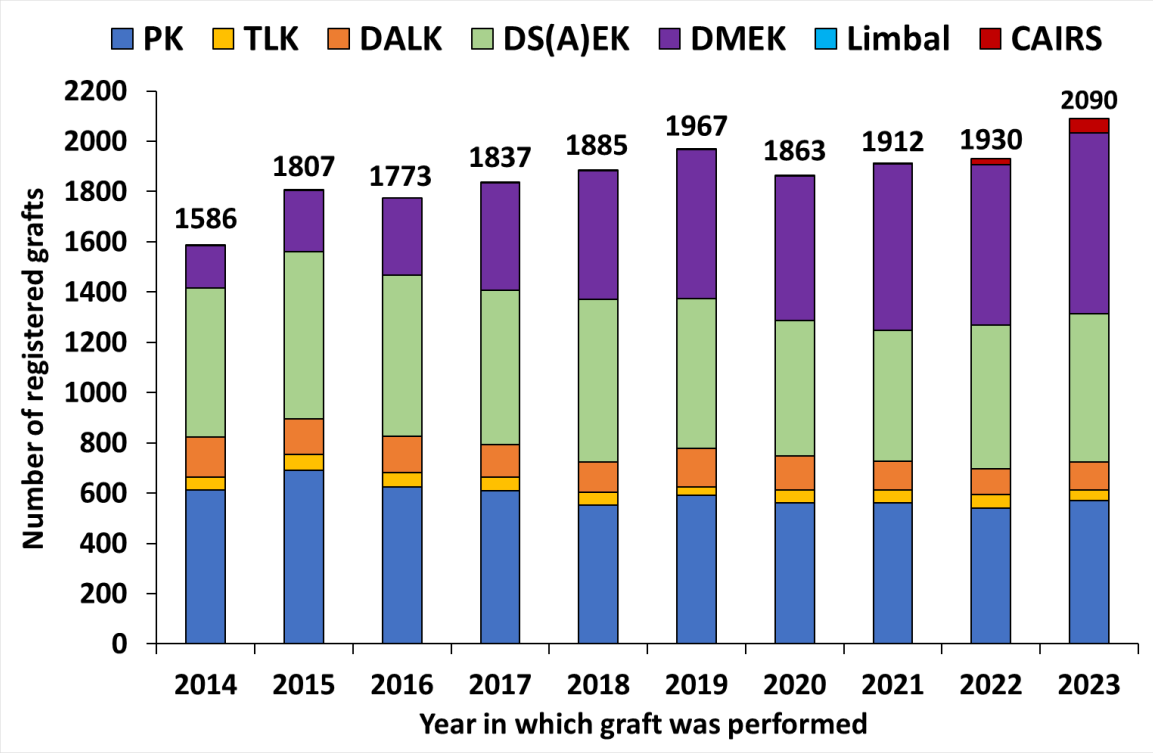


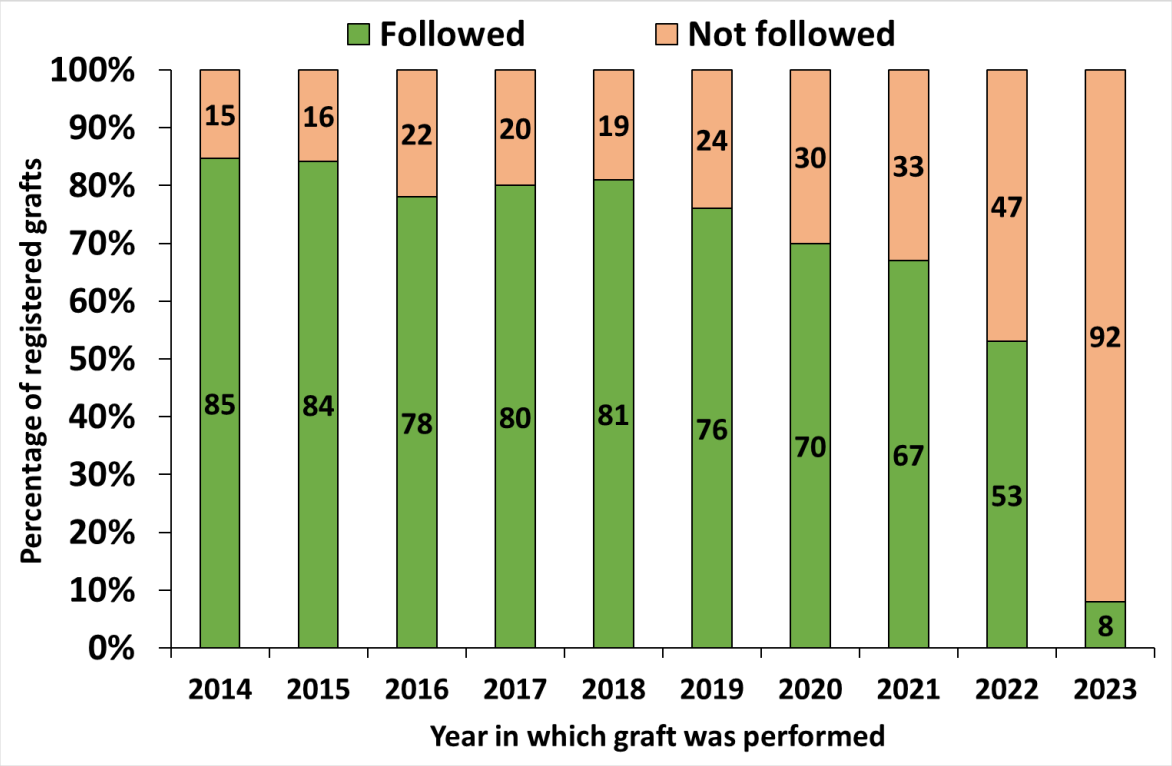
Table 3 Percentage of grafts registered annually with the ACGR, by graft type, 2014 to 2023

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
PK	39%	38%	35%	33%	29%	30%	30%	29%	28%	27%
TLK	3%	3%	3%	3%	3%	2%	3%	3%	3%	2%
DALK	10%	8%	8%	7%	6%	8%	7%	6%	5%	5%
DS(A)EK	37%	37%	36%	34%	34%	30%	29%	27%	30%	28%
DMEK	11%	13%	17%	23%	27%	30%	31%	35%	33%	34%
Limbal	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	0%	<1%
CAIRS	0%	0%	0%	0%	0%	0%	0%	<1%	1%	3%
Total	**1586**	**1807**	**1773**	**1837**	**1885**	**1967**	**1863**	**1912**	**1930**	**2090**

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.

Three-quarters of grafts will have follow-up provided at least once by 5 years post-graft. A final request for first follow-up will be sent at 5-years post-graft, and if none is received, the graft will be recorded as lost to follow-up. From 5-years onwards, the proportion of grafts followed in single annual cohorts can sometimes reach 90% but tends to average closer to 85%. 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 in the database are failed previous graft (25%), keratoconus (22%), Fuchs' endothelial dystrophy (19%), and endothelial failure/bullous keratopathy (17%). 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 top three indications for each type of graft, excluding repeat procedures, showing the variation across groups. Table 5 shows these data for the 10-year period from 2014 to 2023. Fuchs' endothelial dystrophy is now the most common indication for first graft, followed by endothelial failure/bullous keratopathy, and then keratoconus.

Table 4 Indication for graft, 1985 to 2023, stratified by type of graft

	PK	TLK	DALK	DS(A)EK	DMEK	Limbal	CAIRS	Total
Failed previous graft	29%	15%	4%	25%	21%	9%	3%	25%
Keratoconus	**30%**	6%	**74%**	0%	0%	1%	**88%**	22%
Fuchs' Endothelial Dystrophy	**7%**	0%	0%	**42%**	**62%**	0%	0%	19%
Endothelial failure/bullous keratopathy	**16%**	<1%	<1%	**29%**	**14%**	2%	0%	17%
Herpetic eye disease	5%	6%	**5%**	<1%	<1%	3%	0%	4%
Trauma	3%	3%	1%	**2%**	**<1%**	**24%**	0%	2%
Non-herpetic infection	2%	3%	**4%**	<1%	0%	3%	0%	2%
Corneal ulcers/perforations	2%	**12%**	1%	<1%	0%	**5%**	0%	2%
Corneal degenerations	1%	5%	3%	<1%	<1%	3%	**10%**	1%
Beta-radiation	<1%	**14%**	<1%	0%	0%	**5%**	0%	<1%
Pterygium	<1%	**12%**	0%	0%	0%	2%	0%	<1%
Congenital abnormalities	<1%	<1%	<1%	<1%	<1%	**11%**	0%	<1%
Other	4%	23%	7%	1%	1%	31%	0%	4%
Total	**28620**	**1806**	**2357**	**8673**	**5251**	**88**	**81**	**46876**

Table 5 Indication for graft, 2014 to 2023, stratified by type of graft

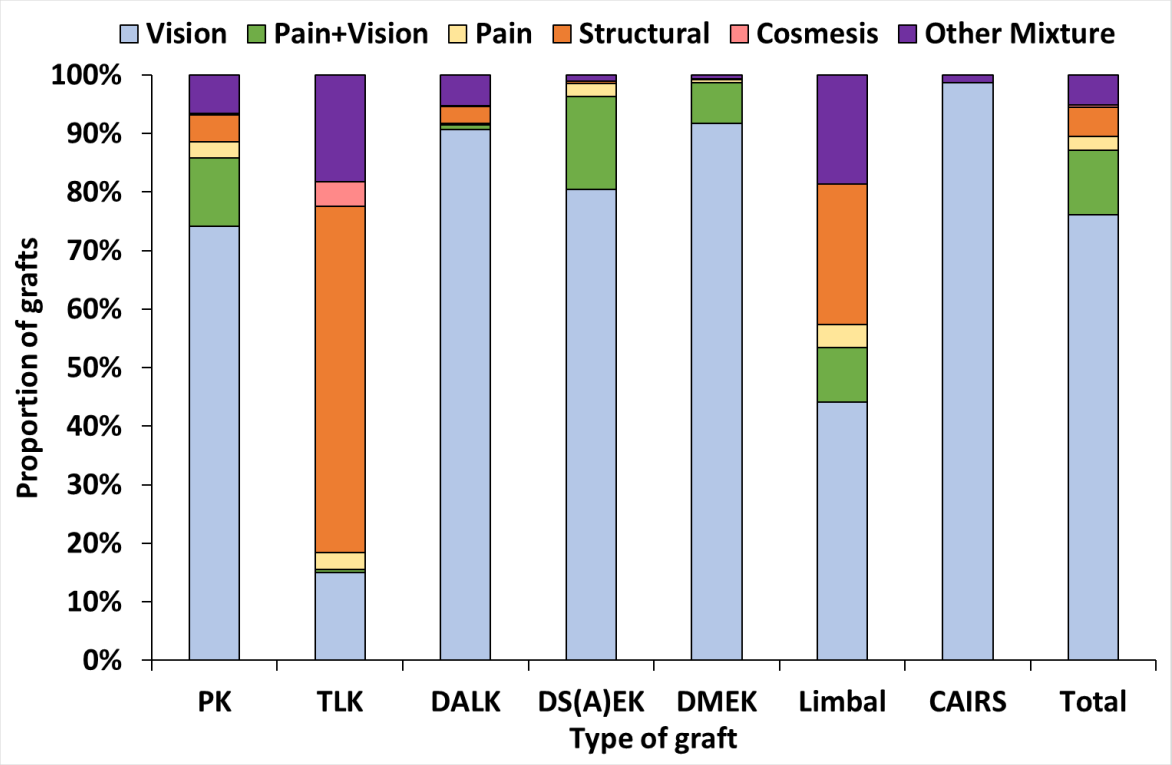
	PK	TLK	DALK	DS(A)EK	DMEK	CAIRS	Total
Failed previous graft	50%	16%	4%	28%	21%	3%	31%
Fuchs' Endothelial Dystrophy	2%	0%	0%	**39%**	**64%**	0%	30%
Endothelial failure/bullous keratopathy	**4%**	0%	<1%	**29%**	**13%**	0%	14%
Keratoconus	**24%**	3%	**72%**	0%	0%	**88%**	13%
Herpetic eye disease	**5%**	8%	**5%**	<1%	<1%	0%	3%
Trauma	3%	4%	1%	**2%**	**<1%**	0%	2%
Non-herpetic infections	4%	6%	**4%**	<1%	0%	0%	2%
Corneal ulcers/perforations	3%	**18%**	2%	<1%	0%	0%	2%
Corneal degenerations	1%	6%	4%	<1%	<1%	**10%**	<1%
Beta-radiation	0%	**10%**	<1%	0%	0%	0%	<1%
Glaucoma	0%	**9%**	0%	0%	0%	0%	<1%
Other	4%	20%	7%	2%	1%	0%	4%
Total	**5912**	**510**	**1310**	**5984**	**4838**	**81**	**18635**

Note: Excludes limbal grafts as n<20.

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 89% of grafts. The most common reason for graft is visual rehabilitation, at 92% of those with data provided. In one-quarter 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 2023, stratified by type of graft, excluding unspecified



Reason for graft was only provided for 67% of grafts performed prior to 1999. 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 almost four-in-five grafts performed from 2019 to 2023. 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, 1999 to 2023, stratified by era of graft

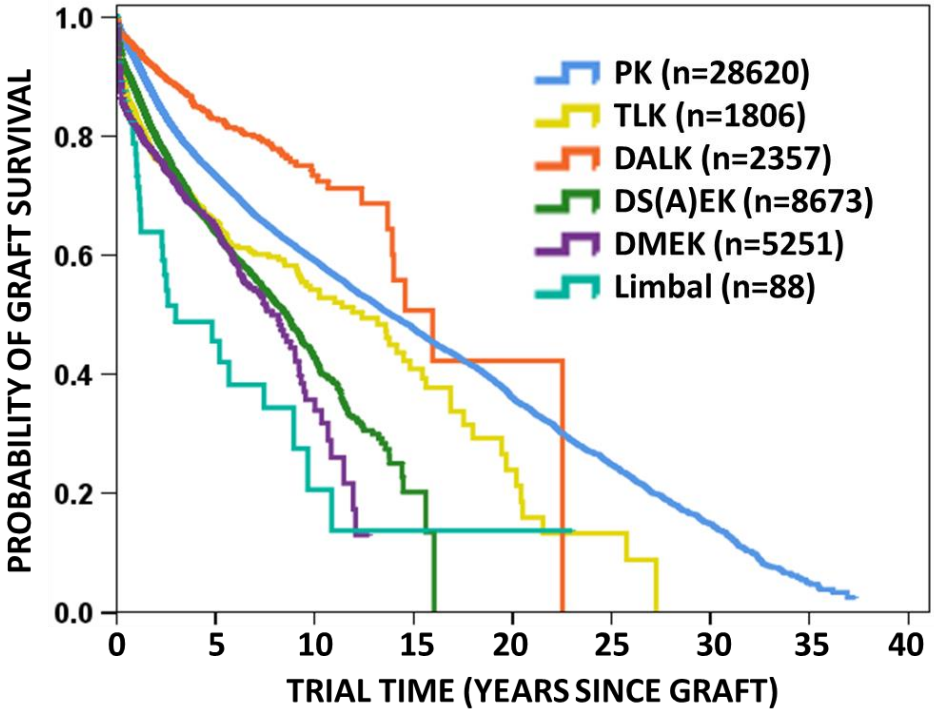
	Vision	Vision + Pain	Pain	Structural	Cosmesis	Other Mix**	Not specified	Total
1999-2003	65%	16%	2%	6%	<1%	7%	4%	4558
2004-2008	70%	13%	2%	6%	<1%	6%	3%	5300
2009-2013	71%	12%	2%	4%	<1%	5%	5%	7221
2014-2018	75%	9%	1%	5%	<1%	5%	5%	8888
2019-2023	79%	6%	1%	4%	<1%	4%	5%	9762
All grafts*	68%	10%	2%	5%	<1%	5%	11%	46876

*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. 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 2023, stratified by type of graft

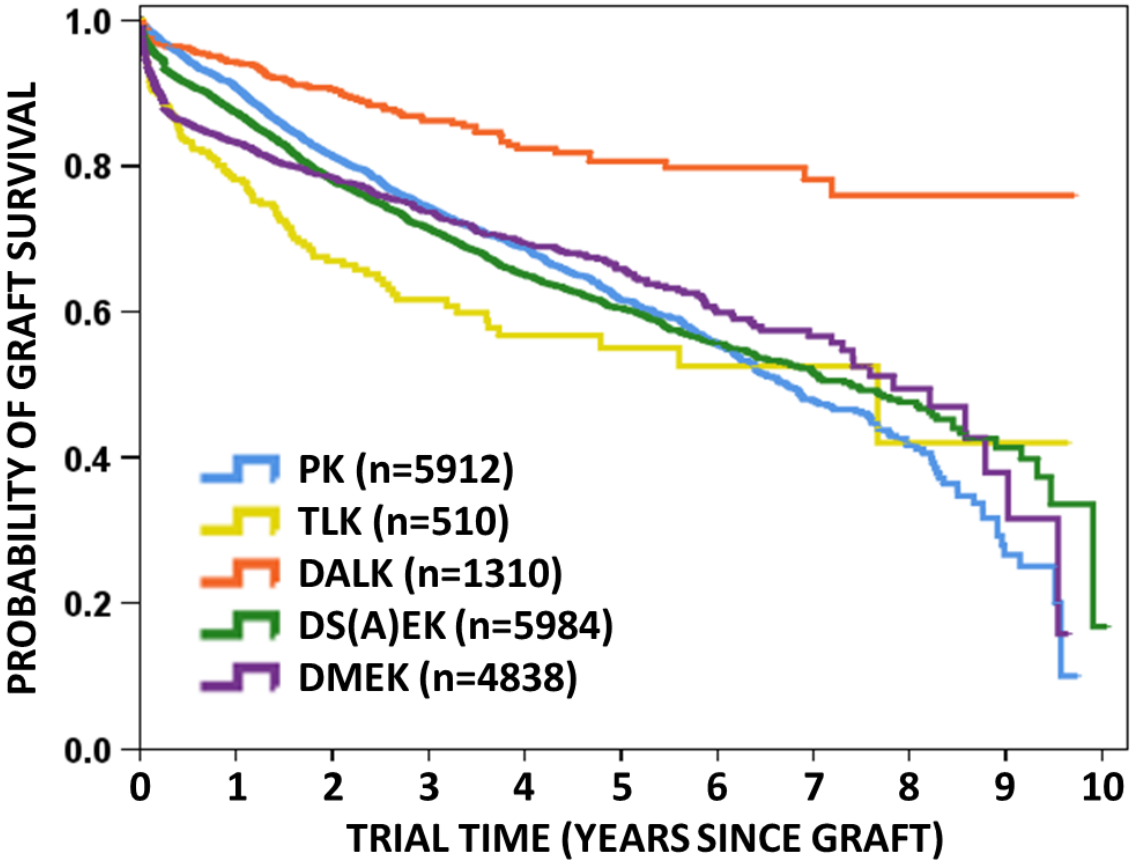


Number at risk	1 Year	2 Years	5 Years	10 Years	15 Years	20 Years	25 Years	30 Years	35 Years
PK	19961	15310	8465	3937	2032	1075	513	200	26
TLK	854	597	276	82	29	9	3	NA	NA
DALK	1277	896	366	81	8	2	NA	NA	NA
DS(A)EK	4927	3727	1692	287	6	NA	NA	NA	NA
DMEK	2178	1409	347	20	NA	NA	NA	NA	NA
Limbal	41	29	14	3	2	2	NA	NA	NA

Survival probability	1 Year	2 Years	5 Years	10 Years	15 Years	20 Years	25 Years	30 Years	35 Years
PK	0.93	0.86	0.73	0.59	0.48	0.36	0.25	0.15	0.05
TLK	0.83	0.76	0.66	0.54	0.41	NA	NA	NA	NA
DALK	0.95	0.91	0.83	0.73	NA	NA	NA	NA	NA
DS(A)EK	0.87	0.80	0.64	0.43	NA	NA	NA	NA	NA
DMEK	0.82	0.77	0.65	0.36	NA	NA	NA	NA	NA
Limbal	0.75	0.64	NA	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 2014 to 2023, stratified by type of graft. Limbal grafts are excluded from this analysis as fewer than 20 were performed during this time period.

Figure 6 Survival of all grafts registered from 2014 to 2023, stratified by type of graft

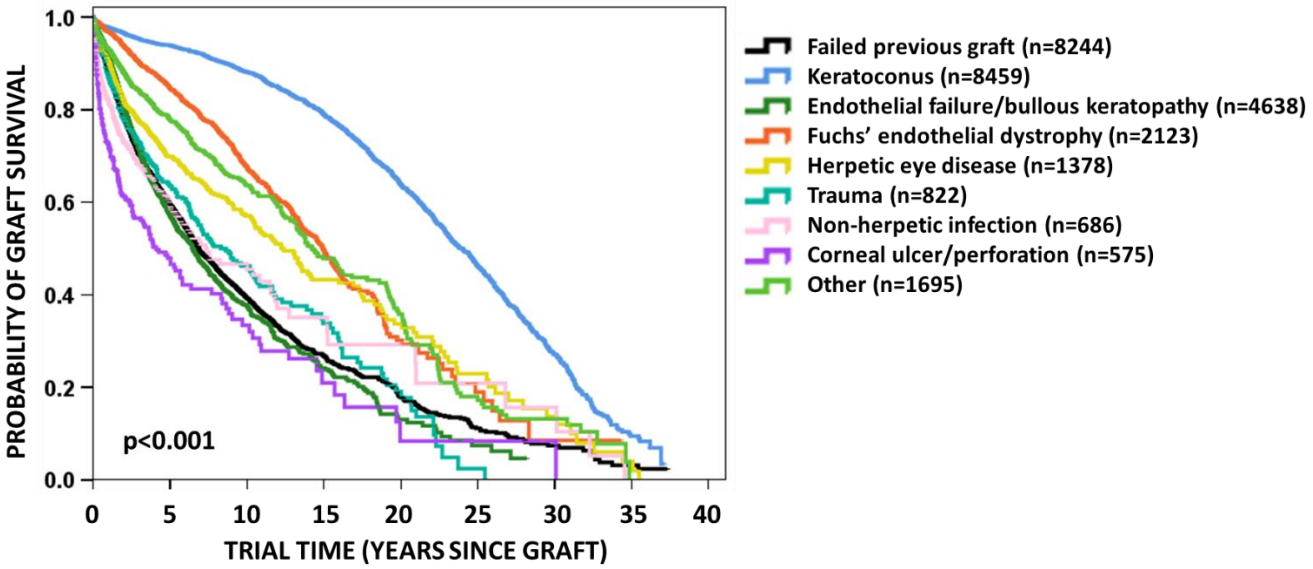


Number at risk	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	7 Years	8 Years	9 Years	10 Years
PK	3296	2247	1529	1053	700	429	220	90	20	NA
TLK	196	118	74	47	31	17	9	4	2	NA
DALK	594	403	255	172	114	74	44	21	6	NA
DS(A)EK	3051	2166	1570	1100	751	453	244	112	32	1
DMEK	2018	1296	800	475	279	148	70	24	6	NA

Survival probability	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	7 Years	8 Years	9 Years
PK	0.91	0.81	0.74	0.69	0.62	0.56	0.48	0.42	0.27
TLK	0.78	0.67	0.62	0.57	0.55	NA	NA	NA	NA
DALK	0.94	0.91	0.86	0.82	0.81	0.80	0.78	0.76	NA
DS(A)EK	0.87	0.78	0.71	0.65	0.61	0.56	0.52	0.48	0.41
DMEK	0.83	0.78	0.74	0.69	0.66	0.60	0.57	0.49	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. Grafts where an underlying condition is known to have led to endothelial failure, perforation, or scar/opacity, are categorised according to the original condition.

Figure 7 Survival of PK performed from 1985 to 2023, stratified by indication for graft

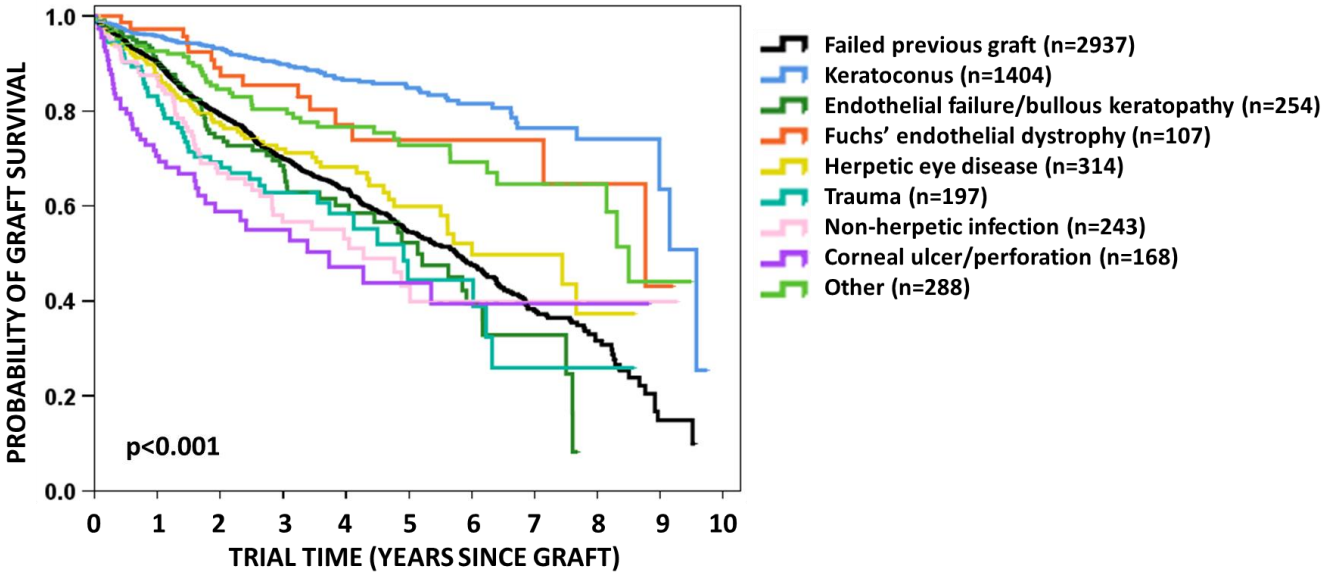


Number at risk	1 Year	2 Years	5 Years	10 Years	15 Years	20 Years	25 Years	30 Years	35 Years
Failed previous graft	5448	4107	2055	736	284	128	45	17	4
Keratoconus	6431	5163	3247	1939	1254	767	406	157	20
Endothelial failure/BK	3091	2146	881	261	80	22	7	NA	NA
Fuchs' endothelial dystrophy	1712	1457	959	449	174	39	10	1	NA
Herpetic eye disease	954	704	372	158	68	39	17	8	2
Trauma	525	393	197	76	34	14	1	NA	NA
Non-herpetic infection	357	251	120	37	12	7	4	3	NA
Corneal ulcer/perforation	250	161	73	24	8	2	1	1	NA
Other	1193	928	561	257	118	56	22	13	NA

Survival probability	1 Year	2 Years	5 Years	10 Years	15 Years	20 Years	25 Years	30 Years	35 Years
Failed previous graft	0.89	0.79	0.60	0.39	0.27	0.18	0.11	NA	NA
Keratoconus	0.98	0.97	0.94	0.88	0.79	0.64	0.46	0.27	0.10
Endothelial failure/BK	0.91	0.81	0.57	0.38	0.24	0.13	NA	NA	NA
Fuchs' endothelial dystrophy	0.97	0.94	0.85	0.68	0.50	0.30	NA	NA	NA
Herpetic eye disease	0.90	0.82	0.70	0.57	0.43	0.34	NA	NA	NA
Trauma	0.87	0.78	0.63	0.46	0.34	NA	NA	NA	NA
Non-herpetic infection	0.82	0.73	0.60	0.47	NA	NA	NA	NA	NA
Corneal ulcer/perforation	0.73	0.61	0.48	0.33	NA	NA	NA	NA	NA
Other	0.93	0.88	0.78	0.64	0.48	0.36	0.17	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 2014 to 2023.

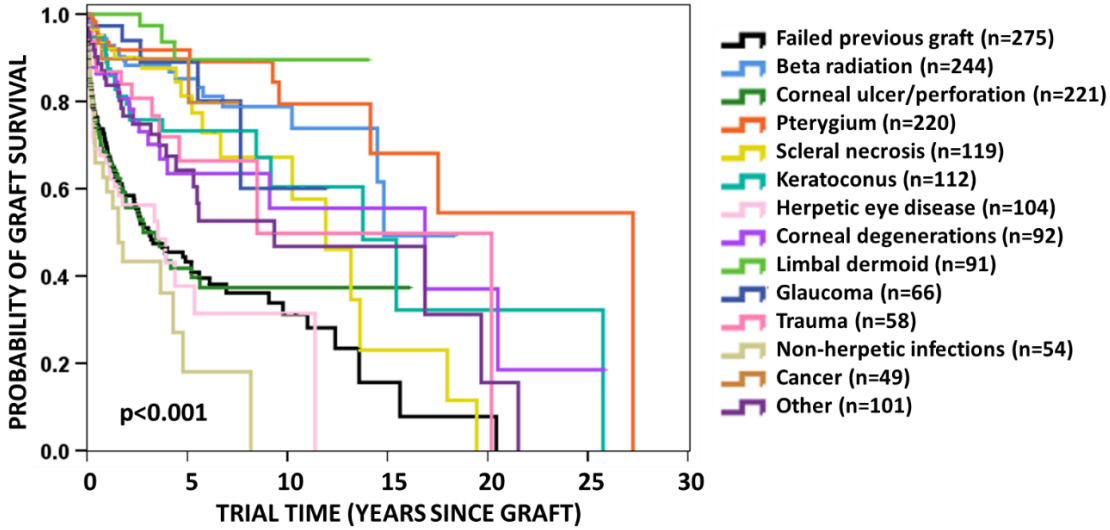
Figure 8 Survival of PK performed from 2014 to 2023, stratified by indication for graft



Number at risk	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	7 Years	8 Years	9 Years
Failed previous graft	1643	1136	763	535	352	219	108	42	8
Keratoconus	823	578	383	261	183	107	57	22	6
Endothelial failure/BK	149	88	62	39	22	14	6	NA	NA
Fuchs' endothelial dystrophy	68	52	39	24	16	12	10	3	1
Herpetic eye disease	179	122	90	61	38	22	11	4	NA
Trauma	91	61	38	22	11	8	3	2	NA
Non-herpetic infection	113	64	40	27	13	9	3	2	2
Corneal ulcer/perforation	60	35	25	15	11	5	2	1	NA
Other	170	111	89	69	54	33	20	14	3

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	0.70	0.64	0.55	0.48	0.38	0.32
Keratoconus	0.96	0.93	0.90	0.87	0.85	0.82	0.76	0.74
Endothelial failure/BK	0.90	0.74	0.69	0.60	0.52	NA	NA	NA
Fuchs' endothelial dystrophy	0.97	0.89	0.85	0.77	NA	NA	NA	NA
Herpetic eye disease	0.87	0.78	0.72	0.68	0.60	0.52	NA	NA
Trauma	0.83	0.69	0.63	0.58	NA	NA	NA	NA
Non-herpetic infection	0.87	0.67	0.57	0.53	NA	NA	NA	NA
Corneal ulcer/perforation	0.71	0.59	0.55	NA	NA	NA	NA	NA
Other	0.93	0.85	0.80	0.77	0.73	0.65	0.65	NA

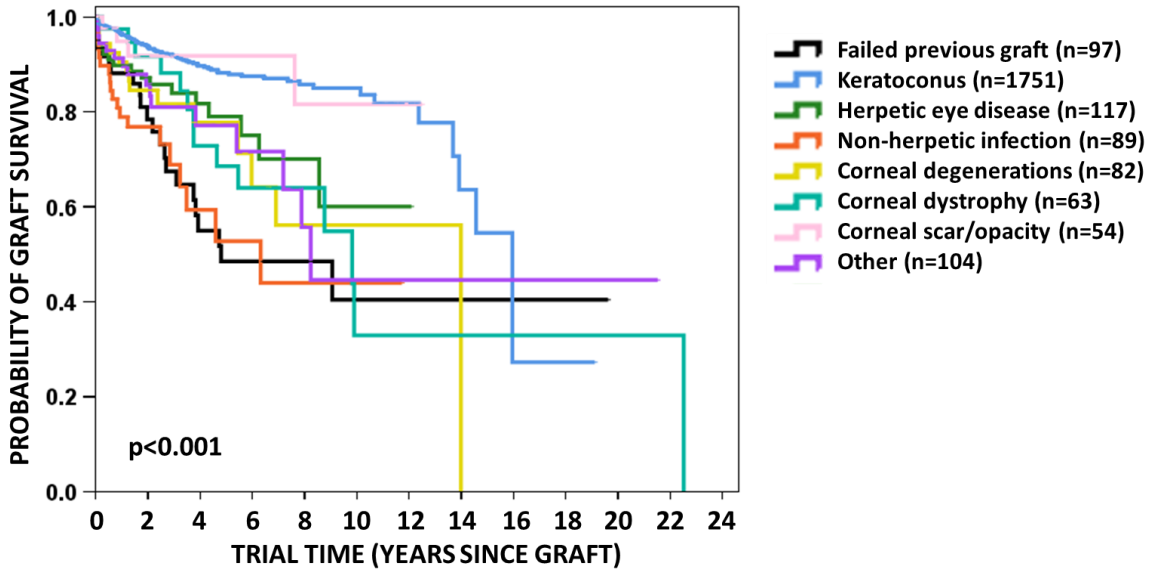
Figure 9 Survival of TLK performed from 1985 to 2023, stratified by indication for graft



Number at Risk	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	8 Years	10 Years
Failed previous graft	117	82	57	46	39	29	17	11
Beta radiation	125	87	73	61	44	37	26	16
Corneal ulcer/perforation	80	46	32	26	20	13	7	2
Pterygium	115	77	60	45	36	30	23	14
Scleral necrosis	54	40	35	29	22	15	8	7
Keratoconus	59	44	35	26	22	19	12	9
Herpetic eye disease	38	24	16	8	6	4	3	2
Corneal degeneration	53	34	26	20	16	12	10	6
Limbal dermoid	57	43	35	25	21	16	8	5
Glaucoma	31	27	15	12	11	6	3	1
Trauma	34	29	23	14	10	6	5	1
Non-herpetic infection	18	8	6	4	2	1	1	NA
Cancer	22	15	11	9	9	4	NA	NA
Other	51	41	32	26	18	12	10	8

Survival probability	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	8 Years
Failed previous graft	0.69	0.59	0.51	0.47	0.43	0.40	NA
Beta radiation	0.94	0.88	0.88	0.88	0.85	0.81	0.79
Corneal ulcer/perforation	0.68	0.56	0.50	0.43	0.42	NA	NA
Pterygium	0.94	0.92	0.92	0.92	0.92	0.89	0.89
Scleral necrosis	0.92	0.90	0.88	0.88	0.81	NA	NA
Keratoconus	0.89	0.79	0.76	0.73	0.73	NA	NA
Herpetic eye disease	0.66	0.56	NA	NA	NA	NA	NA
Corneal degeneration	0.86	0.81	0.73	0.67	NA	NA	NA
Limbal dermoid	1.00	1.00	0.97	0.94	0.90	NA	NA
Glaucoma	0.97	0.94	NA	NA	NA	NA	NA
Trauma	0.87	0.84	0.81	NA	NA	NA	NA
Non-herpetic infection	NA	NA	NA	NA	NA	NA	NA
Cancer	0.90	NA	NA	NA	NA	NA	NA
Other	0.84	0.77	0.75	0.68	NA	NA	NA

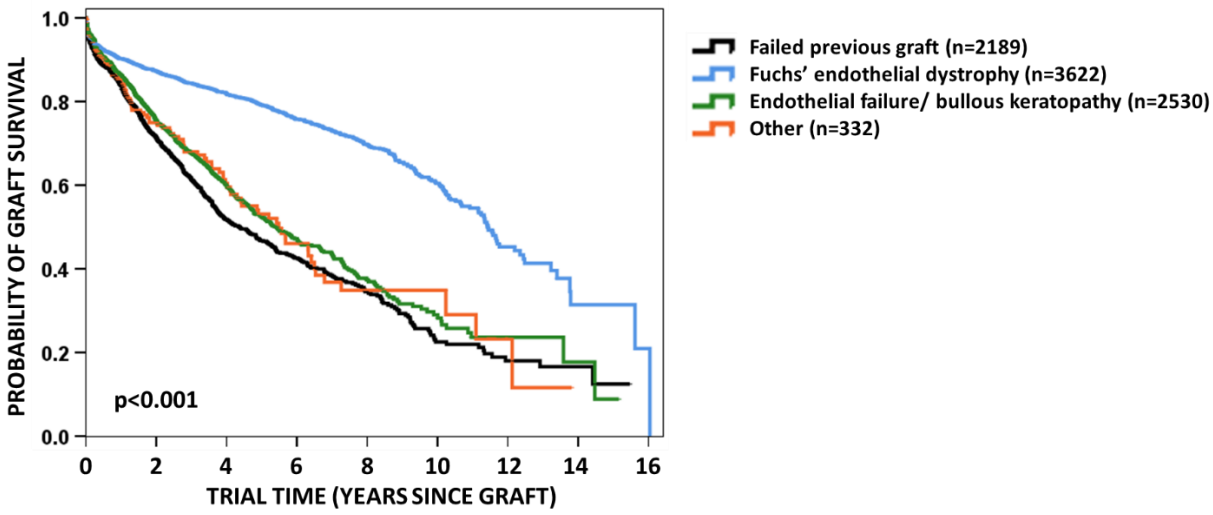
Figure 10 Survival of DALK performed from 2000 to 2023, stratified by indication for graft



Number at risk	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	8 Years	10 Years	12 Years	14 Years
Failed previous graft	46	30	24	17	15	13	9	5	2	1
Keratoconus	945	650	462	341	262	208	124	61	24	9
Herpetic eye disease	73	63	46	37	26	18	7	4	1	NA
Non-herpetic infection	41	27	15	11	8	6	3	1	NA	NA
Corneal degenerations	46	33	26	19	12	9	5	3	1	NA
Corneal dystrophy	37	27	23	19	16	13	8	3	3	2
Corneal scar/opacity	34	28	19	15	11	10	8	2	1	NA
Other	55	38	28	19	16	10	6	2	1	1

Survival probability	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	8 Years	10 Years	12 Years
Failed previous graft	0.88	0.78	0.68	NA	NA	NA	NA	NA	NA
Keratoconus	0.96	0.94	0.92	0.90	0.88	0.88	0.86	0.85	0.82
Herpetic eye disease	0.90	0.87	0.84	0.82	0.79	NA	NA	NA	NA
Non-herpetic infection	0.80	0.77	NA	NA	NA	NA	NA	NA	NA
Corneal degenerations	0.90	0.85	0.82	NA	NA	NA	NA	NA	NA
Corneal dystrophy	0.97	0.92	0.88	NA	NA	NA	NA	NA	NA
Corneal scar/opacity	0.95	0.92	NA	NA	NA	NA	NA	NA	NA
Other	0.91	0.86	0.81	NA	NA	NA	NA	NA	NA

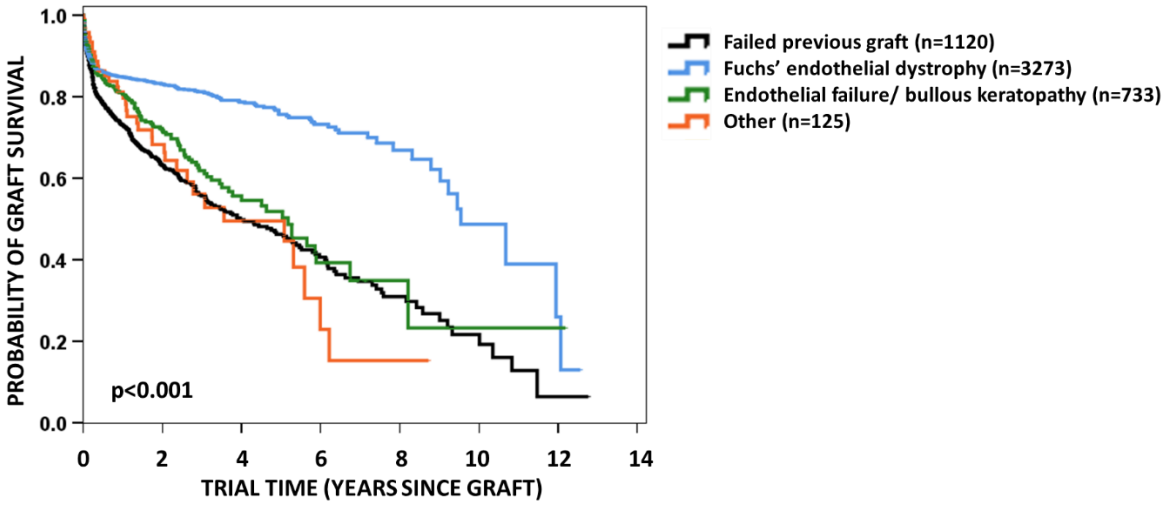
Figure 11 Survival of DS(A)EK performed from 2006 to 2023, stratified by indication for graft



Number at risk	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	8 Years	10 Years	12 Years	14 Years
Failed previous graft	1174	806	556	377	289	208	105	41	19	6
Fuchs' endothelial dystrophy	2290	1894	1575	1295	1034	762	438	199	56	8
Endothelial failure/bullous keratopathy	1295	907	644	453	316	227	91	38	15	3
Other	168	120	90	69	53	34	15	9	2	NA

Survival probability	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	8 Years	10 Years	12 Years
Failed previous graft	0.84	0.71	0.61	0.52	0.47	0.43	0.35	0.23	NA
Fuchs' endothelial dystrophy	0.90	0.87	0.84	0.82	0.79	0.76	0.70	0.61	0.45
Endothelial failure/bullous keratopathy	0.86	0.75	0.68	0.60	0.52	0.47	0.37	0.29	NA
Other	0.84	0.75	0.68	0.60	0.53	0.46	NA	NA	NA

Figure 12 Survival of DMEK performed from 2007 to 2023, stratified by indication for graft



Number at risk	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	8 Years	10 Years
Failed previous graft	464	293	201	128	91	65	26	9
Fuchs' endothelial dystrophy	1389	922	583	359	211	122	35	11
Endothelial failure/bullous keratopathy	271	158	86	50	35	16	4	1
Other	54	36	17	13	10	3	1	NA

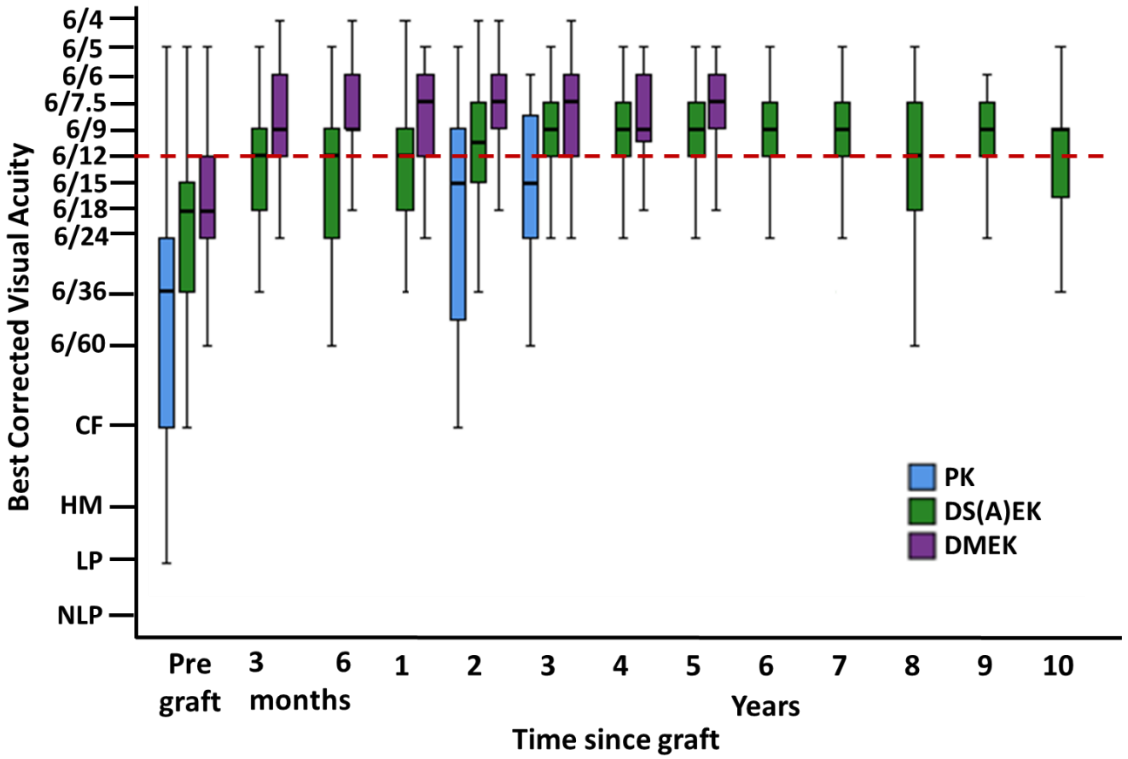
Survival probability	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	8 Years
Failed previous graft	0.73	0.63	0.56	0.50	0.46	0.41	0.31
Fuchs' endothelial dystrophy	0.85	0.83	0.81	0.79	0.76	0.73	0.67
Endothelial failure/bullous keratopathy	0.81	0.72	0.62	0.56	0.52	NA	NA
Other	0.81	0.68	NA	NA	NA	NA	NA

5 Visual Acuity

The most commonly reported goal of corneal transplantation is improvement in vision. 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 and keratoconus, respectively. These data are for grafts performed since 2008 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.

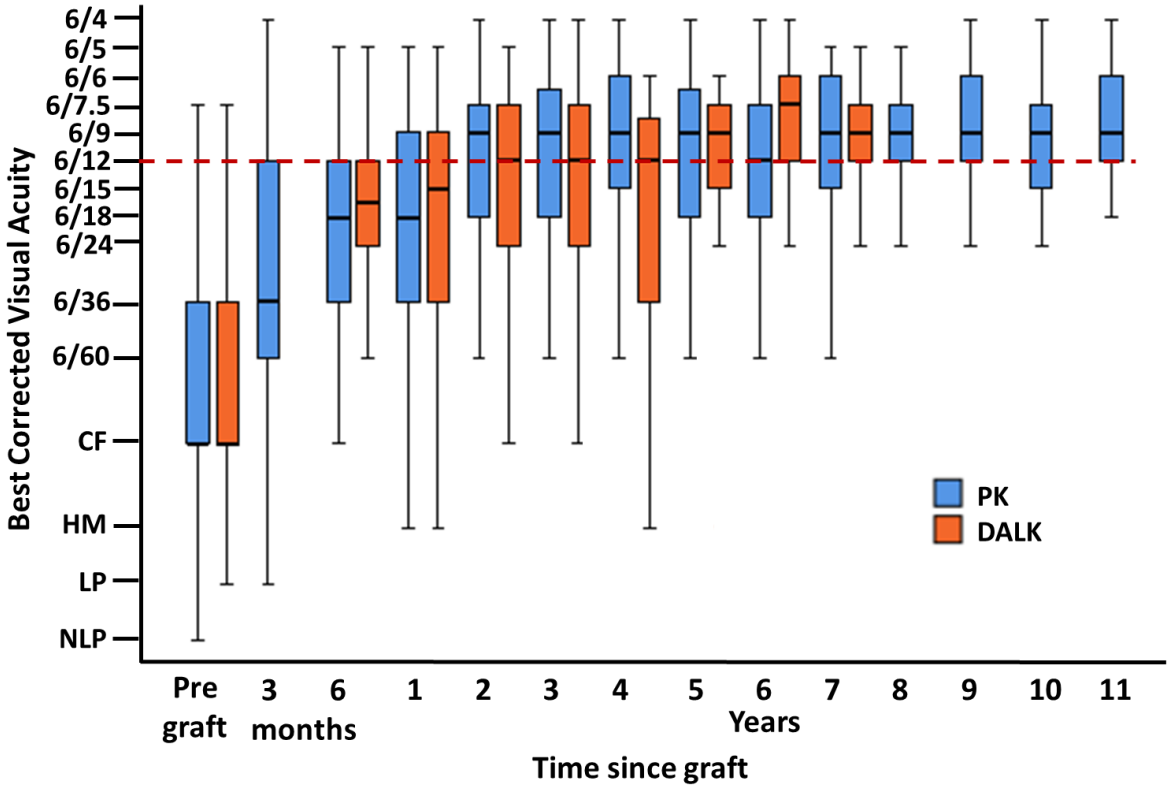
Figure 13 BCVA at various time points pre- and post-graft, in surviving grafts performed for Fuchs' endothelial dystrophy from 2008 to 2023, stratified by type of graft



	Pre graft	3 months	6 months	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	7 Years	8 Years	9 Years	10 Years
PK	326	5	5	19	39	20	16	11	19	14	10	6	6
DS(A)EK	3334	165	198	313	252	212	132	133	99	81	51	35	31
DMEK	3095	166	174	334	185	128	68	45	25	11	6	3	1

For Fuchs endothelial dystrophy, the pre-graft BCVA varied significantly across graft types, with DMEK performed in eyes with significantly better vision than either PK or DS(A)EK, and DS(A)EK in eyes with better vision than PK (all p<0.001). The median BCVA for eyes undergoing PK had not reached a functional level of 6/12 at either 2 years or 3 years post-graft. The vision in these eyes were significantly poorer than both EK groups at each of these times. There were insufficient data to analyse outcomes for PK at any other time points. Functional vision was achieved in a majority of eyes with surviving grafts at 3 months for both EK groups. Median BCVA was 6/12 or better in surviving grafts, at yearly intervals up to 5 years post graft for DMEK and 10 years for DS(A)EK. Post-graft BCVA in eyes undergoing DMEK was significantly better (p<0.001) than that in those undergoing DS(A)EK, up to 7 years post-graft.

Figure 14 BCVA at various time points pre- and post-graft, in surviving grafts performed for keratoconus from 2008 to 2023, 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	10 Years	11 Years
PK	2486	61	43	276	201	132	95	87	54	48	26	35	22	22
DALK	1508	18	48	139	93	57	35	22	26	27	10	9	4	3

Pre-graft visual acuity was significantly poorer in eyes that underwent PK (p<0.001). Median post-graft BCVA achievement reached functional vision by 2 years post-graft for both PK and DALK performed for keratoconus. This was maintained to 11 years for PK and 7 years for DALK. The post-graft BCVA was significantly better following PK compared to DALK at 2 years (p=0.017), and 4 years (p=0.031) post graft.